
JOURNAL
OF THE
ARNOLD ARBORETUM

VOL. XXIV

APRIL, 1943

NUMBER 2

TAXONOMIC NOTES ON THE OLD WORLD SPECIES
OF WINTERACEAE

A. C. SMITH

With six text-figures

As implied by the title, this treatment is not monographic, its scope being primarily to bring together references to the taxonomic literature, to indicate the acceptable name for each species, to discuss the typification of species and genera, to mention the known distribution, and to cite the specimens available in American herbaria. From some regions there is a deplorable lack of available herbarium material in this country, and consequently my remarks must often be based upon those of previous workers. Some revision of specific lines will be inevitable when European herbaria can again be consulted, and doubtless a certain amount of revision will be dictated by future collections throughout the range of the family. For some of the genera in certain regions, such as New Guinea and Australia, enough material is available to make feasible the preparation of preliminary keys, but these are presented with the reservation that modification and expansion will be essential.

Prof. I. W. Bailey and the writer have in preparation a treatment of the inter-relationships of the six genera which make up the Winteraceae and the place of the family in the Ranales. Consequently, in the present paper I omit comprehensive generic descriptions and detailed discussions of generic relationships. During the preparation of this work, I have repeatedly called upon Prof. Bailey for advice, and many of the conclusions expressed are the result of his painstaking preparation and examination of material for microscope study. It is hoped that the present paper will provide an outline of the classification of the family and will bring up to date the sometimes complicated synonymy.

The Winteraceae has an interesting bihemispheric and presumably palaeoantarctic distribution, which I have recently discussed (5). In the Old World, species are found in the area roughly outlined by the Philippines, Borneo, New Guinea, the Solomon Islands, New Caledonia, New

Zealand, Tasmania, and eastern Australia. All of the six known genera occur in this region, while only one, *Drimys*, extends to America, where it is found from Cape Horn to southern Mexico. According to my interpretation, the family now contains about 88 species, of which only four are American. The type genus is *Drimys* (of which *Wintera* is a synonym), and the type species of *Drimys* is *D. Winteri* J. R. & G. Forst. of southern South America. This species, therefore, is the nomenclatural basis of the family.

Many students have included *Drimys* and *Illicium* L. in the same family, subfamily, or tribe. There appear to be no sound morphological, anatomical, or genetic reasons for this broad concept. The wood structure, nodal anatomy, pollen grain, carpellary structure, and many other characters of *Illicium* remove it from the Winteraceae. Whitaker (8) has pointed out that *Illicium* cytologically bears no resemblance to either *Drimys* or members of the Magnoliaceae, being suggestive, in its chromosome number, of *Schizandra* and *Kadsura*. Therefore the genus is not considered in connection with the present study; whether it should be placed in the Schizandraceae or in an independent family must be decided by future study.

The directors and curators of the following institutions have kindly loaned herbarium material, which is cited in this paper as indicated by the parenthetical letters: Arnold Arboretum (A), Field Museum of Natural History (F), Gray Herbarium (GH), Missouri Botanical Garden (M), New York Botanical Garden (NY), University of California (UC), and U. S. National Museum (US).

- WINTERACEAE Lindl. Nat. Syst. Bot. ed. 2. 17, pro parte. 1836; Miers in Ann. Mag. Nat. Hist. III. 2: 33, pro parte. 1858, Contrib. Bot. 1: 123, pro parte. 1861; Eichl. in Mart. Fl. Bras. 13(1): 127. 1864; Hutchinson in Kew Bull. 1921: 185, pro parte. 1921, Fam. Fl. Pl. Dicot. 81, pro parte. 1926.
- Wintereae* R. Br. ex DC. Reg. Veg. Syst. Nat. 1: 548, pro parte. 1817; Lindl. Introd. Nat. Syst. Bot. 26, pro parte. 1830, Nixus Pl. 9, pro parte. 1833.
- Magnoliaceae* Trib. *Illicieae* DC. Prodr. 1: 77, pro parte. 1824.
- Magnoliaceae* Trib. *Wintereae* R. Br. ex Meisn. Pl. Vasc. Gen. 3 (pars alt. 5), pro parte. 1836; Benth. & Hook. f. Gen. Pl. 1: 17, pro parte. 1862.
- Magnoliaceae* Subordo *Illicieae* DC. ex Endl. Gen. Pl. 838, pro parte. 1839.
- Magnoliaceae* Trib. *Illicieae* Sect. *Winterineae* Spach, Hist. Nat. Veg. 7: 435. 1839.
- Magnoliaceae* II. *Wintereae* Lindl. Veg. Kingd. ed. 2. 419, pro parte. 1847, ed. 3. 419, pro parte. 1853.
- Magnoliaceae* III. *Illicieae* Prantl in E. & P. Nat. Pfl. III. 2: 18, pro parte. 1891.
- Magnoliaceae* Subfam. *Drimyoideae* Harms in Ber. Deutsch. Bot. Gesell. 15: 358. 1897.
- Drimytacées* v. Tiegh. in Jour. de Bot. 14: 354. 1900.
- Drimytacées* Trib. *Drimytées* and Trib. *Exospermées* v. Tiegh. in Jour. de Bot. 14: 354. 1900.
- Drimytaceae* Diels in Bot. Jahrb. 55: 133. 1917.
- Magnoliaceae* Subfam. *Drimyoideae* Skottsbo. in Växternas Liv 5: 349, pro parte. 1940.

The principal interpretations of the taxonomic position of the group now known as the Winteraceae are indicated by the above synonymy. Most of the early writers linked *Drimys* and *Illicium* in the same tribe or section,

but the classification of Spach, in 1839, is interesting because of his proposal of different sections of the Tribe Illicieae for these two genera. Harms' concept of Magnoliaceae Subfam. Drimyoideae (1897) is synonymous with the Winteraceae in the modern sense. The most precise delimitation of the family, however, has been that of van Tieghem (6), who apparently neglected to use the Latin form of his "Drimytacées" anywhere in his treatment.

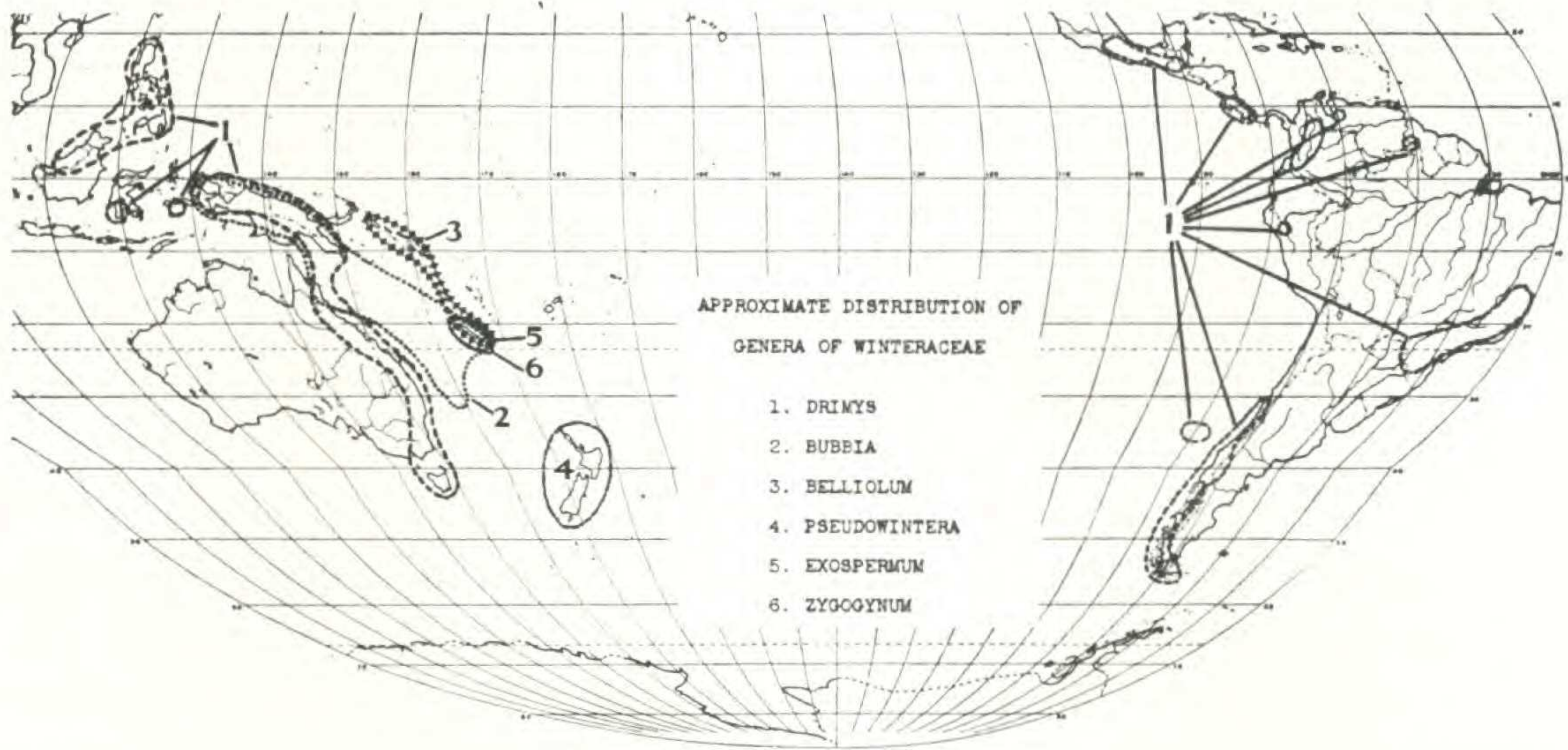


FIG. 1. Approximate distribution of the genera of Winteraceae. From Goode's series of base maps, no. 108.

KEY TO THE GENERA IN THE OLD WORLD

- Calyx submembranaceous or papyraceous, calyptrate, completely enclosing the bud, at length splitting into 2 or 3 lobes and often caducous; plants dioecious or polygamodioecious; carpels free, with the stigmatic surface extended along the ventral suture; anther-locules vertical or subvertical, distally extrorse-lateral, the filaments comparatively slender, subterete1. *Drimys* Sect. *Tasmannia*.
- Calyx papyraceous to subcoriaceous, persistent, often rotate, not calyptrate, not enclosing the bud; plants hermaphrodite; carpels often with a short stigmatic ridge (or elliptic or subpeltate stigma in *Zygygynum*); filaments carnose, flattened.
- Carpels free, sometimes appressed-contiguous (in *Bubbia* and *Exospermum*), not developing into a syncarp.
- Inflorescence terminal or pseudoterminal, the flowers or inflorescence-rays aggregated around the growing point.
- Anther-locules apical, horizontal or oblique at the apex of distally enlarged filaments, not exceeded by the connective.
- Carpels usually free even in young flowers, rarely appressed-contiguous at anthesis; placental surface essentially corresponding to the external stigmatic surface2. *Bubbia*.
- Carpels appressed-contiguous, free only after anthesis; placentation diffuse and scattered on distal surfaces5. *Exospermum*.
- Anther-locules vertical, extrorse-lateral, exceeded apically by the connective
.....3. *Belliolium*.
- Inflorescence axillary; flowers fasciculate (rarely solitary), often arising from branchlets of several years' growth4. *Pseudowintera*.
- Carpels firmly concrescent, the placentation primarily on the dorsal surface; fruit a syncarp6. *Zygygynum*.

1. DRIMYS

Drimys J. R. & G. Forst. Char. Gen. 83. 1776.

The Old World representatives of the genus all belong in the Section *Tasmannia*, which is separable from the American Section *Wintera* as pointed out in my recent treatment of that group (4: 10). I have already listed the principal references to the genus *Drimys* as a whole, and consequently the following references pertain only to the Old World portion of the genus.

Drimys Sect. **Tasmannia** (R. Br.) F. v. Muell. Pl. Indig. Col. Vict. **1**: 20. 1860; Baill. Hist. Pl. **1**: 160. 1867-69.

Tasmannia R. Br. ex DC. Reg. Veg. Syst. Nat. **1**: 445, 547. 1817, ex DC. Prodr. **1**: 78. 1824; Lindl. Nat. Syst. Bot. ed. 2. 17. 1836; Meisn. Pl. Vasc. Gen. 3 (pars alt. 5). 1836; Spach, Hist. Nat. Veg. **7**: 433. 1839; Endl. Gen. Pl. 838. 1839, Enchir. Bot. 428. 1841; Lindl. Veg. Kingd. ed. 2. 419. 1847; Hook. f. Fl. Tasm. **1**: 10. 1855; Miers in Ann. Mag. Nat. Hist. III. **2**: 109. 1858, Contrib. Bot. **1**: 138. 1861.

Drimys J. R. & G. Forst. sensu Benth. Fl. Austral. **1**: 49. 1863; F. M. Bailey, Queensl. Fl. **1**: 18. 1899.

Drimys Sect. *Winterana* Baill. Hist. Pl. **1**: 160. 1867-69.

Drimys Sect. *Eudrimys* v. Tiegh. in Jour. de Bot. **14**: 288, pro parte. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108, pro parte. 1906; non DC. (1824).

Drimys occurs in the Old World in Australia and Tasmania, New Guinea, the Philippines, Borneo, Celebes, and Amboina. Its occurrence in other high eastern Malayan islands is possible, but thus far no other regions are represented in the herbaria examined by me, nor have published records of other occurrences been found. It is a typically montane genus, reaching elevations of 3800 m. in New Guinea and Borneo, but descending to sea-level in the southern part of its range in Tasmania. Six species are known from Australia and Tasmania, 29 from New Guinea, and one from the Philippines-Amboina region. In order to make this treatment more usable, I propose to discuss and key the Australian and the New Guinean-Malayan species separately.

The genus *Tasmannia* was originally based on *T. aromatica* R. Br. and *T. insipida* R. Br., Australian species which are referable to *Drimys lanceolata* (Poir.) Baill. and *D. insipida* (R. Br.) Pilger respectively. The Sections *Tasmannia* and *Wintera* are sharply differentiated, but their common origin is indisputable and the separating characters do not seem generic in quality. The total variability of *Drimys* in the Old World, especially in New Guinea, is considerable, particularly when the region is compared to America, where, in an area extending from southern Mexico to Cape Horn, no more than four species can be recognized. I have attempted to use essentially similar standards for specific delimitation in the two hemispheres. In spite of the greater number of Old World species, it is much easier to draw specific lines in Sect. *Tasmannia* than in Sect. *Wintera*, while intraspecific variability seems much less pronounced in the Old World than in the New. From this fact one might assume that isolating mechanisms have been at work longer in Sect. *Tasmannia* than in

Sect. *Wintera* and that extensive interchange of genetic material between parts of the population ceased earlier in the Old World than in the New.

Following De Candolle's treatments, many subsequent writers maintained the genus *Tasmannia* as distinct from *Drimys*, but modern students have submerged it. I believe that it is well retained as a section with a status similar to that of the American Section *Wintera* (Murr.) DC. Baillon proposed to divide *Drimys* into four sections, but one of these, Sect. *Winterana*, is difficult to typify from his brief treatment. I assume that he meant to base it on "*Winterania*" *lanceolata* Poir., an Australian species, and consequently I list it as a synonym of Sect. *Tasmannia*. Van Tieghem's four sections of *Drimys* are all based exclusively on American species with the exception of Sect. *Eudrimys*, which, curiously enough, includes the most extreme forms of the genus. The Old World representatives of van Tieghem's Section *Eudrimys* are referable to Mueller's Sect. *Tasmannia*, but the actual type of Sect. *Eudrimys* v. Tiegh. is the American *D. Winteri*.

AUSTRALIAN SPECIES

The six recognizable Australian species are quite distinct from the New Guinean representatives, all being characterized by having their pistillate flowers lacking stamens (a feature of only a few New Guinean species). However, the Australian species do not appear to form a single coherent group, and it is not to be assumed that they were derived from a single recent prototype. *Drimys lanceolata* and its two allies (*D. stipitata* and *D. Vickeriana*) are entirely distinct from any New Guinean species and appear to have no close relatives; they have probably been isolated for a long time from the main trends of evolution in the Section *Tasmannia*.

The only Australian species which appears to have a close affinity with the New Guinean species is, as might be expected, *D. membranea*, of Queensland, which has much in common with *D. hatamensis* Becc. This relationship has already been suggested by Diels (in Bot. Jahrb. **54**: 242. 1916). However, *D. hatamensis* (like its closest New Guinean allies *D. dictyophlebia* Diels and *D. coriacea* Pulle) has pistillate flowers with at least three carpels, while those of *D. membranea* have a single carpel. There are also differences in the shape of the perianth-parts and fruits, but in foliage the Queensland species and *D. hatamensis* are remarkably similar.

Ridley (in Trans. Linn. Soc. II. Bot. **9**: 12. 1916) has pointed out the possible relationship of his *D. densifolia* to *D. insipida* (i. e. *D. dipetala*), but the Australian species differs in its narrower leaves, larger petals, more numerous stamens in staminate flowers, and usually solitary carpel. The actual relationship of these two species is probably quite remote, in spite of the similarity of their leaf-bases.

It seems desirable to redescribe three of the older Australian species and one novelty, but I do not find it necessary to repeat Vickery's excellent descriptions (7) of *D. purpurascens* and *D. stipitata*.

KEY TO THE AUSTRALIAN SPECIES

- Leaf-blades with (5-)7-18 short anastomosing secondary nerves, these erecto-patent at an angle of (20-)30-45°, the blades (4-)6-20 cm. long; petals 2, very rarely 3.
- Leaf-blades gradually narrowed toward a suddenly obtuse and often auriculate base; carpels 1 (rarely 2) in both staminate and pistillate flowers; fruit 1-carpellate, ellipsoid, usually 13-20 mm. long, obtuse at base, with (8-)15-27 seeds 1. *D. insipida*.
- Leaf-blades acute to attenuate at base.
- Petals up to 8 mm. long at anthesis; filaments 0.5-3.5 mm. long; carpels 1 (rarely 2 or 3) in both staminate and pistillate flowers; fruit 1-carpellate, often nearly subglobose, not more than 10 mm. long, rounded at base, usually with 4-7 seeds 2. *D. membranacea*.
- Petals 10-12 mm. long; filaments 2-6 mm. long; carpels 2-8 in both staminate and pistillate flowers; fruit 2-8 (usually 3- or 4-)-carpellate, the carpels oblong-globose, 10-15 mm. long, short-stipitate 3. *D. purpurascens*.
- Leaf-blades with 3-7 elongate secondary nerves, these sharply ascending at an angle of 10-20° or completely immersed and obscure, the blades not exceeding 11 cm. in length, acute to attenuate at base, never auriculate.
- Sepals 3.5-6 mm. in diameter; petals 4-9 mm. long, 1.5-3.5 mm. broad; stamens in staminate flowers 15-45; fruiting carpels with at least 6 seeds; leaf-blades rarely less than 4 cm. long and 1 cm. broad.
- Petals in staminate flowers 5-8, in pistillate flowers usually 4; carpels in both staminate and pistillate flowers 1, rarely 2 or 3, subglobose or ellipsoid, sessile, the stigmatic ridge occupying the entire apex and ventral edge; fruit 1-carpellate, essentially subglobose, rounded at base 4. *D. lanceolata*.
- Petals 2; carpels in staminate flowers 1 or 2, in pistillate flowers 2-8, obovoid-ellipsoid, obviously stipitate, the stigmatic ridge obliquely apical or extending to base of ovary; fruit 2-8 (usually 3- or 4-)-carpellate, the carpels oblong-ellipsoid, conspicuously stipitate 5. *D. stipitata*.
- Sepals 2.5-3 mm. in diameter; petals 2, not exceeding 3 mm. in length and 1 mm. in breadth at anthesis; stamens in staminate flowers 10-12; carpel in staminate flowers 1, subsessile; fruit 1-carpellate, subglobose, with about 3 seeds; leaves congested, the blades small, up to 16 mm. long and 5 mm. broad 6. *D. Vickeriana*.

1. ***Drimys insipida*** (R. Br.) Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Druce in Rep. Bot. Exch. Cl. Brit. Isles **1916**: 620. 1917; Domin in Bibl. Bot. **22** [Heft 89]: 115. 1925; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 82. 1937. *Tasmannia insipida* R. Br. ex DC. Reg. Veg. Syst. Nat. **1**: 445. 1817; DC. Prodr. **1**: 78. 1824; Miers in Ann. Mag. Nat. Hist. III. **2**: 110. 1858; F. v. Muell. Pl. Indig. Col. Vict. **1**: 21, as synonym. 1860; Miers, Contrib. Bot. **1**: 140. 1861. *Tasmannia dipetala* R. Br. ex DC. Prodr. **1**: 78, as synonym. 1824. *Tasmannia monticola* A. Rich. Sert. Astrolab. 50. 1834 (Atlas pl. 19. 1833); F. v. Muell. Pl. Indig. Col. Vict. **1**: 21, as synonym. 1860. *Drimys dipetala* F. v. Muell. Pl. Indig. Col. Vict. **1**: 21. 1860; Benth. Fl. Austral. **1**: 49. 1863; Baill. Hist. Pl. **1**: 160. 1867-69; F. M. Bailey, Syn. Queensl. Fl. **5**. 1883; C. Moore, Handb. Fl. N. S. Wales 13. 1893; Maiden in Agric. Gaz. N. S. Wales **5**: 600 (Dorrigo For. Res. 8). 1894; Parment. in Bull. Sci. Fr. & Belg. **27**: 227, 301. 1896; F. M. Bailey, Queensl. Fl. **1**: 18. 1899; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; F. M. Bailey, Compr. Cat. Queensl. Pl. 21. f. 7. 1913; Maiden & Betche, Census N. S. Wales Pl. 79. 1916.

Shrub or small tree, up to 3 m. or more high, the branchlets subterete, brownish or nigrescent, rugulose, slender, 1-3 mm. in diameter near apices; leaves scattered, sometimes appearing subopposite toward apex of branchlets; petioles rugulose, shallowly canaliculate, often inconspicuous, 0.5-4 mm. long, 0.7-2 mm. in diameter; leaf-blades chartaceous, brownish or

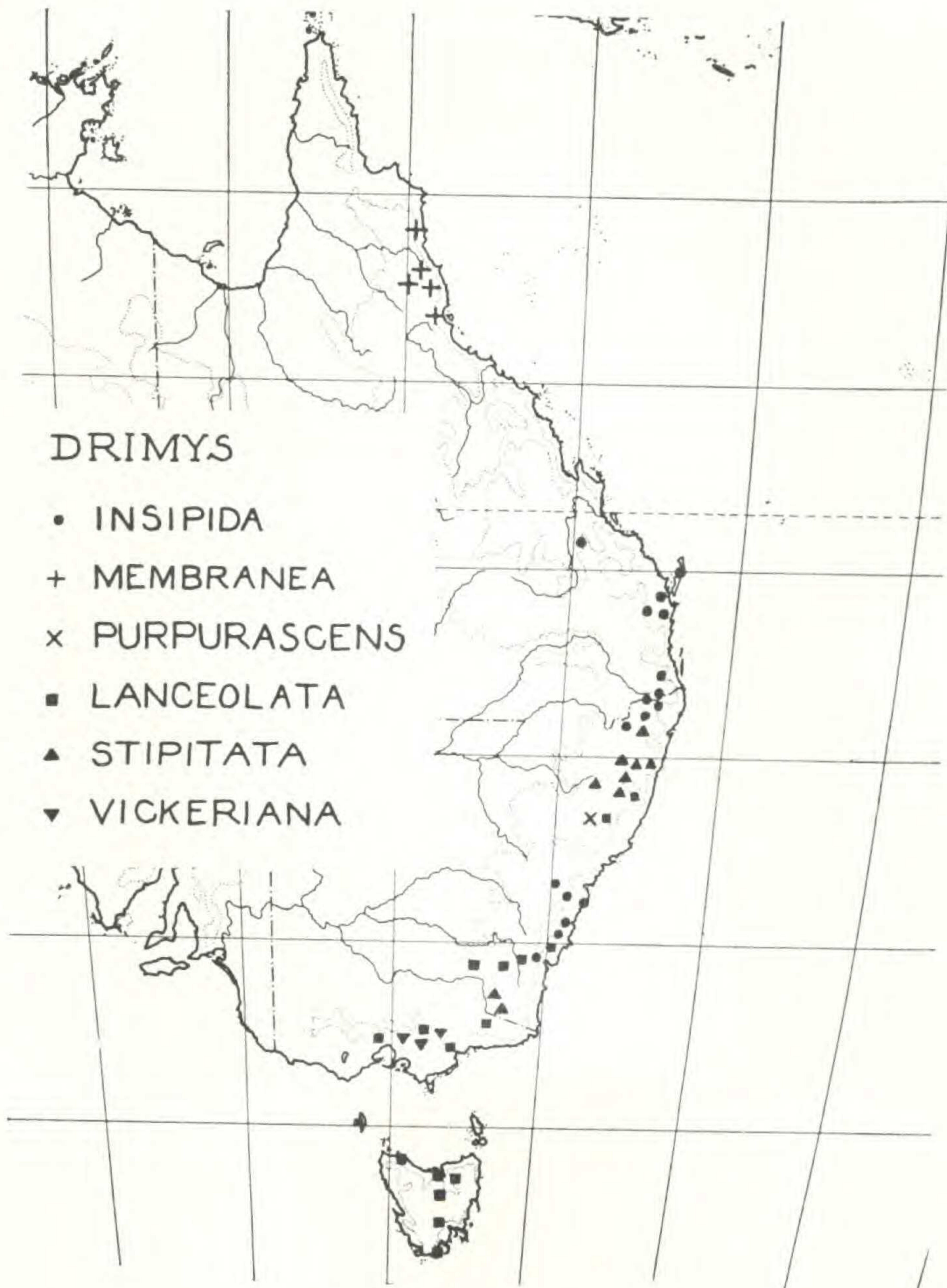


FIG. 2. Approximate known distribution of the Australian and Tasmanian species of *Drimys*. From Goode's series of base maps, no. 107.

dark green when dried, oblong- or obovate-lanceolate, (4-)8-20 cm. long, (0.7-)1.5-3.7 cm. broad, gradually narrowed to an abruptly obtuse or inconspicuously auriculate base, gradually and often long-acuminate at apex, slightly recurved at margin, the costa slightly raised or narrowly canaliculate above, prominent beneath, the secondary nerves 7-18 per side, short, erecto-patent at an angle of (20-)30-45°, usually freely anastomosing toward margin, prominulous on both surfaces, the veinlets loosely reticulate and faintly prominulous or obscure on both surfaces; flowers single, numerous, congested around the growing point of branchlets, at length pseudolateral, subtended by numerous bracts, these papyraceous, oblong, 5-11 mm. long, obtuse, soon caducous, the pedicels slender, 10-25 mm. long at anthesis (sometimes shorter in pistillate plants), up to 30 mm.

long in fruit; staminate flowers: sepals 2, submembranaceous, densely but obscurely yellow-glandular, ovate-deltoid, 5–7 mm. long and broad, obtusely apiculate at apex; petals 2, submembranaceous, eglandular to densely glandular-punctate, obovate- or spatulate-linear, 7.5–13 mm. long, 1.5–2.5 mm. broad, conspicuously narrowed at base, obtuse at apex; stamens usually 30–38, 3- or 4-seriate, the filaments subcarnose, ligulate, obscurely pellucid-glandular, 1–5 mm. long, the locules 1–2 mm. long; carpel 1 (rarely 2), sterile, ellipsoid, slightly falcate, often yellow-glandular, 2.5–4 mm. long at anthesis, the stigmatic ridge elongate; pistillate flowers: sepals as in staminate but usually longer than broad, obtuse at apex; petals similar but smaller, up to 10 mm. long, 1–1.5 mm. broad; stamens none; carpel 1, ellipsoid, about 3 mm. long at anthesis, obtuse at apex, the stigmatic ridge extending from apex nearly to base, the ovules about 28; fruit 1-carpellate, ellipsoid, at maturity (9–)13–20 mm. long and (5–)7–10 mm. broad, obtuse at base and apex, obscurely marked ventrally by the stigmatic ridge, the pericarp carnose, copiously yellow-glandular, the seeds (8–)15–27, loosely imbedded in sparse mucilaginous pulp, coriaceous, black, shining, obovoid, slightly or strongly falcate, 3–3.5 mm. long, 1.5–2.5 mm. broad, acute at base, rounded at apex.

DISTRIBUTION: Southeastern Queensland and eastern New South Wales, from about lat. 24° to 35°30', from sea-level to about 1500 m. in mountains; usually reported as occurring in rain-forest. The type was collected by Brown at or near Port Jackson.

AUSTRALIA: Queensland: Fraser Island, *Epps* 229 (NY); Tinana Creek, *White* 3476 (A); Imbil, *Wilson* (A); Eumundi, *Simmonds* (A); Tallebudgera, *White* 1866 (A); Roberts Plateau, Lamington National Park, *White* 6062 (A, NY); Cunningham's Gap, Main Range, *White* 6862 (A, NY); Mt. Spurgeon, *White* 10737 (A); Mt. Greville, *White* 9949 (A), *Everist* 556 (A); Tambourine Mt., *White* 3568 (A); National Park, Macpherson Range, *White* (A); Mistake Range, *White* (A), *Bailey* (US); New South Wales: Richmond River, *Henderson* (UC); Upper Williams River at Salisbury, *White* 11473 (A); Wentworth Falls, *Maiden* (UC), *Burges* (NY); Moonambale, *Maiden* (A); Port Jackson, *Caley* (A).

NATIVE NAME: *Pepper shrub*.

White reports the sepals as red, the petals paler red, and the stamens yellow; other collectors have not mentioned the flower-color. The fruit is usually noted as purple to black at maturity, but some collectors indicate that it is white (probably only when juvenile).

The first occurrence of the name *Tasmannia dipetala* in literature is De Candolle's reference to it, in the Prodrômus, as a synonym of *T. insipida*. In transferring the species to *Drimys*, Mueller unfortunately selected the epithet *dipetala* and has been followed by many students. The correct transfer of the epithet *insipida* was apparently first made in 1906. Subsequently to Pilger's publication of the binomial *Drimys insipida*, both Druce and Domin proposed the combination as new.

Richard's description and illustration of *Tasmannia monticola* portray an apparently hermaphrodite flower, with numerous stamens and two fertile carpels. In staminate flowers of *D. insipida* one occasionally finds two carpels, but these are always sterile; the fact that Richard illustrates ovules suggests either faulty observation or a very unusual individual, since there can be no doubt of the identity of his plant with *D. insipida*.

2. *Drimys membranacea* F. v. Muell. Fragm. Phyt. Austr. **5**: 175. 1866; F. M. Bailey, Syn. Queensl. Fl. **5**. 1883; Parment. in Bull. Sci. Fr. & Belg. **27**: 227, 302, as *D. membranacea*. 1896; F. M. Bailey, Queensl. Fl. **1**: 18. 1899; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108, as *D. membranacea*. 1906; F. M. Bailey, Compr. Cat. Queensl. Pl. **21**. 1913.

Shrub or tree up to 15 m. high, the branchlets subterete or slightly angled, rugulose, brownish, 1.5–4 mm. in diameter near apices; leaves often more or less congested toward apices of branchlets, the petioles stout, 1–2 mm. broad, often flattened and narrowly winged, 1–7 mm. long; leaf-blades chartaceous or subcoriaceous, brownish when dried, narrowly obovate, (4–)6–13 cm. long, (1–)1.5–4.3 cm. broad, gradually attenuate at base and decurrent on the petiole, obtusely cuspidate or short-acuminate at apex, slightly recurved at margin, the costa broad, slightly raised or shallowly canaliculate above, usually subprominent beneath, the secondary nerves (5–)8–14 per side, erecto-patent at an angle of 30–45°, prominulous on both surfaces, freely anastomosing near margin, the veinlets reticulate, faintly prominulous on both surfaces; flowers single, clustered around growing point of branchlets, at length pseudolateral, subtended by bracts, these papyraceous, oblong, about 5 mm. long, soon caducous, the pedicels slender, 12–33 mm. long (sometimes shorter in pistillate plants); staminate flowers: sepals 2, submembranaceous, eglandular or obscurely yellow-glandular, suborbicular-deltoid, 4–5.5 mm. long and broad, obtuse or rounded at apex; petals 2, similar to sepals in texture, obovate-linear, about 8 mm. long and 2–3.5 mm. broad at anthesis, narrowed to base, obtuse or rounded at apex; stamens 25–35, 3- or 4-seriate, the filaments subcarnose, subterete-ligulate, obscurely yellow-glandular, 0.5–3.5 mm. long, the locules 0.7–1.3 mm. long; carpels 1 or 2 (or 3, ex Mueller), sterile, obovoid-ellipsoid, 2.5–3 mm. long at anthesis, the stigmatic ridge obvious, elongate; pistillate flowers: sepals and petals similar to staminate in texture, the sepals ovate-oblong, 3.5–6 mm. long, 2.5–3 mm. broad, the petals about 8 mm. long and 2–2.5 mm. broad; stamens none; carpel 1, ellipsoid, 2.5–4 mm. long at anthesis, short-stipitate, the stigmatic ridge obvious, extending from apex nearly to base, the ovules 14–36 (or possibly sometimes more, with some aborted); fruit 1-carpellate, oblong-ellipsoid to nearly subglobose, 6–10 mm. long and 5–7 mm. broad at maturity, rounded at base and apex, the stigmatic ridge elongate, obscure, the pericarp carnose, obscurely yellow-glandular, the seeds usually 4–7 (with many aborted), black, shining, obovoid, slightly falcate, 3–3.5 mm. long and about 2 mm. broad at maturity, subacute at base, rounded at apex.

DISTRIBUTION: Eastern Queensland, from about lat. 16° to 18°, at elevations of 800–1600 m. (or perhaps occurring down to sea-level); in rain-forest or low bush, sometimes common (Kajewski).

AUSTRALIA: Queensland: Thornton Peak, *Brass 2291* (A); Gadgarra, Peeramon, Atherton, *Kajewski 1065* (A, NY, UC); Mt. Bartle Frere, *Kajewski 1291* (A, NY); Bellenden Ker, near summit, *White* (A); Rockingham Bay, *Dallachy* (GH, NY).

The sepals and petals are reported as white by Brass, green by Kajewski; the mature fruit is said to be black. The young leaves, bracts, and sometimes the whole plant are often tinged with purple.

Mueller's original description is based on an apparently staminate specimen collected by Dallachy "ad fontes fluminis Mackay-River," whereas

the Dallachy specimens cited above, from Rockingham Bay, are pistillate. The type specimen must have very young leaves, as none of those seen by me could be considered membranaceous. Mueller describes the petals as 2 or 3, but all my specimens have them 2.

Drimys membranacea is doubtless a close relative of *D. insipida*, which it resembles in leaf-shape and texture, differing primarily in the quite different leaf-base. Both species have the sepals and petals of the pistillate flowers narrower than those of the staminate. In *D. membranacea* both sepals and petals are shorter and usually proportionately narrower. The fruit of *D. membranacea* appears to be consistently smaller and with fewer seeds than that of *D. insipida*.

3. ***Drimys purpurascens*** Vickery in Proc. Linn. Soc. N. S. Wales **62**: 78. *f. 1; pl. 5*. 1937; Fraser & Vickery, l. c. 288. 1937.

DISTRIBUTION: Thus far known only from a restricted area on the Mt. Royal Ranges in the vicinity of the Barrington Tops, New South Wales, at an altitude of 1350–1500 m.

AUSTRALIA: New South Wales: Barrington Tops, *Boorman* (US), *White 11472* (A).

The original description is very complete, being based upon several collections from the same locality; the type is *Fraser & Vickery* (in May, 1936). The species is readily distinguished from its allies, *D. insipida* and *D. membranacea*, by its more numerous carpels and several-carpellate fruits, as well as by its usually broader leaf-blades and broad subulate petioles. White indicates that the species is very common locally in both rain-forest and *Eucalyptus* forest.

4. ***Drimys lanceolata*** (Poir.) Baill. Hist. Pl. **1**: 159. *f. 205–207*. 1867–69; Parment. in Bull. Sci. Fr. & Belg. **27**: 225, as synonym. 1896; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Ewart, Fl. Vict. 517. 1930; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 82. 1937; Fraser & Vickery, l. c. 288. 1937.

Winterania lanceolata Poir. Encycl. **8**: 799. 1808.

Tasmania aromatica R. Br. ex DC. Reg. Veg. Syst. Nat. **1**: 445. 1817; Deless. Ic. Sel. **1**: 22. *pl. 84*. 1820; DC. Prodr. **1**: 78. 1824; Lindl. Bot. Reg. **31**: *pl. 43*. 1845; Hook. f. Fl. Tasm. **1**: 11. 1855; Miers in Ann. Mag. Nat. Hist. III. **2**: 110. 1858, Contrib. Bot. **1**: 139. 1861; Baill. Hist. Pl. **1**: 159, as synonym. 1867–69; Meredith, Bush Friends Tasm. Ser. Ult. *pl. 11*. 1891.

Drimys aromatica F. v. Muell. Pl. Indig. Col. Vict. **1**: 20. 1860; Benth. Fl. Austral. **1**: 49. 1863; F. v. Muell. Nat. Pl. Vict. **1**: 19, 187. *f. 44*. 1879, Key Syst. Vict. Pl. **2**: 6. *pl. 3*. 1885, op. cit. **1**: 121. 1888; C. Moore, Handb. Fl. N. S. Wales 13. 1893; Parment. in Bull. Sci. Fr. & Belg. **27**: 225, 298. *pl. 11, f. 41*. 1896; Rodway, Tasm. Fl. 5. 1903; De Wildem. in Ic. Sel. Hort. Then. **5**: 127. *pl. 191*. 1906; Maiden & Betche, Census of N. S. Wales Pl. 79. 1916; Ewart, Handb. For. Trees Vict. For. 116. 1925; Johnstone in Jour. Roy. Hort. Soc. **62**: 96. *f. 25*. 1937.

Drimys aromatica var. *aromatica* Parment. in Bull. Sci. Fr. & Belg. **27**: 226. 1896.

?*Drimys xerophylla* Parment. in Bull. Sci. Fr. & Belg. **27**: 226, 299, *nomen subnudum*. 1896; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 83, as synonym. 1937.

Shrub or small tree, 2–10 m. high, the branchlets subterete or slightly angled, rugulose, reddish brown or purplish, slender, 1–3 mm. in diameter toward apices; leaves scattered, the petioles rugulose, shallowly canaliculate, 2–15 mm. long, 0.7–2 mm. in diameter, often swollen at base; leaf-blades subcoriaceous or chartaceous, pale green or yellow-green when dried, oblanceolate or narrowly elliptic-obovate, (3–)4–11 cm. long, 0.6–3 cm.

broad, attenuate at base and decurrent on the petiole, obtuse or subacute at apex, narrowly recurved at margin, the costa subplane or slightly raised above, more obviously elevated beneath, the secondary nerves 3–7 per side, elongate, sharply ascending at an angle of 10–20°, inconspicuously anastomosing toward margin, immersed or prominulous above, prominulous beneath, the veinlets immersed or obscurely prominulous beneath; flowers single, aggregated around growing point of branchlets, at length pseudolateral, subtended by bracts, these papyraceous, oblong, obtuse, 4–13 mm. long, soon caducous, the pedicels slender, 8–25 mm. long (staminate flowers) or 4–12 mm. long (pistillate flowers and fruits); staminate flowers: sepals 2 (rarely 3), membranaceous, densely but obscurely pellucid-glandular, ovate-suborbicular, 3.5–6 mm. long and broad, obtuse at apex; petals 5–8, resembling sepals in texture, linear-oblong or narrowly obovate, 4–9 mm. long, 1.5–3.5 mm. broad, obtuse at apex; stamens 15–28, 2- or 3-seriate, the filaments eglandular, 0.7–3.5 mm. long, the locules ellipsoid, 0.9–1.3 mm. long, the carpel 1 (rarely 2 or perhaps 3), sterile, ellipsoid, 0.7–1 mm. long at anthesis, the stigmatic ridge obvious, occupying entire rounded apex and extending to base; pistillate flowers: sepals as in staminate or slightly narrower; petals 4 (in all available specimens), as in staminate but 3.5–5.5 mm. long and 0.7–2 mm. broad; stamens none; carpel 1 (rarely 2), subglobose or ellipsoid, about 1.5 mm. in diameter at anthesis, rounded at base and apex, the stigmatic ridge extending over apex and along entire ventral edge, the ovules 10–18; fruit 1-carpellate, oblong-subglobose or subglobose, often appearing obscurely bilobed, 5–10 mm. long and 5–8 mm. broad at maturity, rounded at base and apex, the stigmatic ridge elongate, the pericarp subcarnose, rugulose, obscurely yellow-glandular, the seeds 6–18, dark castaneous or black, shining, obovoid, strongly falcate, 2.5–3.5 mm. long, 1.3–2 mm. broad, acute at base, rounded at apex.

DISTRIBUTION: New South Wales, Victoria, and Tasmania, extending southward from about lat. 31°, at elevations up to 1200 m. in the north, occurring down to sea-level in Tasmania; usually found in wet forest in New South Wales and Victoria; abundant in Tasmania and forming dense thickets on margins of streams in rich humid soil.

AUSTRALIA: New South Wales: Hastings River, *Moore* (GH); Braidwood, *Baker* (US); Sugarloaf Mt., Braidwood, *Boorman* (US); Bago, *de Beuzeville* 201 (A); Tumbarumba, *Cabbage* (GH); Victoria: *Kuntze* 20113 (NY); Mt. Baw Baw, *Melvin* (GH); Mt. Mueller, near Mt. Baw Baw, *Mueller* (GH); Tasmania: *R. Brown* s. n. or 2918 (type coll. of *Tasmannia aromatica*, F, GH, M, NY), *Gunn* (A, F, GH, M, US), *Archer* (GH); Golden Valley, toward Westbury Road, *Rodway* 125 (A); Mt. Wellington, *Gunn* 777 (GH, M), *Oldfield* (US); without definite locality: *Labillardière* (TYPE COLL., GH), *Paterson* (A).

NATIVE NAMES: *Pepper-tree*, *native pepper*, *mountain pepper*, *wild pepper-corn*.

Mueller describes the petals as white with a red or green streak down the middle; colored plates show the petals as white, but none of the specimens seen by me have adequate color-notes.

Many of the descriptions cited above, such as those of Hooker, Mueller, and De Wildeman, are based on a more comprehensive concept than admitted in my description; these authors include in the species material from the Victorian Alps which is much reduced in foliage and floral char-

acters and which I describe below as *D. Vickeriana*. The species which Vickery has described as *D. stipitata* is also included in some of the early concepts of the present species, as indicated by references to the petals as 2–8 in number; I believe that *D. lanceolata* never has fewer than 4 petals. Mueller describes the ovaries as 1–11 and in some of his plates shows 4 carpels; his concept doubtless included specimens which are referable to *D. stipitata*, but even there no more than 8 carpels have otherwise been reported.

5. ***Drimys stipitata*** Vickery in Proc. Linn. Soc. N. S. Wales **62**: 80. f. 2. 1937.

Drimys aromatica var. *pedunculata* Maiden in Agric. Gaz. N. S. Wales **5**: 600 (Dorrigo For. Res. 8). 1894; Maiden & Betche, Census N. S. Wales Pl. 79. 1916.

DISTRIBUTION: Fairly common in northeastern New South Wales between about lat. 29° and 32°, at elevations of 600–1200 m., and also occurring near the boundary with Victoria perhaps at slightly higher altitudes; probably to be found elsewhere in New South Wales and in adjacent Victoria.

AUSTRALIA: N e w S o u t h W a l e s : Dorrigo Forest Reserve, Beilsdown Creek, Maiden in 1893 (type coll. of *D. aromatica* var. *pedunculata*, A); Dorrigo State Forest, toward Wild Cattle Creek, White 7572 (A, NY); Mt. Kosciusko, tree-line to about 2100 m., Maiden & Forsyth (UC); Snowy River, Cheel 813 (A, US).

The original description is ample and is based upon several additional collections, the type of the species being Maiden (in 1895), collected at Guy Fawkes. Although *D. stipitata* is scarcely distinguishable from *D. lanceolata* in foliage, the differences in number of petals and carpels, and especially in the shape of the carpels, are quite obvious. The carpels of the present species are conspicuously stipitate in fruiting specimens, and this character is also apparent in both staminate and pistillate flowers. However, there can be no doubt that *D. lanceolata* and *D. stipitata* are close relatives, and I believe that they are too far separated in Vickery's key (7: 83). The pistillate flowers, as in other Australian species, lack stamens, while carpels in the staminate flowers (1 or 2 in my material) are sterile.

6. ***Drimys Vickeriana*** sp. nov. FIG. 3, a-e.

Drimys aromatica var. *alpina* Parment. in Bull. Sci. Fr. & Belg. **27**: 226, 300, *nomen subnudum*. 1896.

Drimys lanceolata var. *parvifolia* Vickery in Proc. Linn. Soc. N. S. Wales **62**: 83. 1937.

Frutex compactus, ramis crassis multiramulosis, ramulis subteretibus cinereis apicem versus 1–3 mm. diametro cicatricibus foliorum delapsorum copiose ornatis; foliis dense congestis, petiolis rugulosis semiteretibus 1–3 mm. longis 0.8–1 mm. diametro, laminis coriaceis siccitate fuscis oblongis vel anguste ellipticis, 8–16 mm. longis, 2–5 mm. latis, basi acutis vel attenuatis, apice obtusis vel rotundatis, margine anguste recurvatis, costa supra obscura vel leviter insculpta subtus plana vel minute elevata, nervis secundariis utrinsecus circiter 3 adscendentibus utrinque immersis vel supra inconspicue impressis, venulis obscuris; floribus singulis aggregatis terminalibus demum pseudolateralibus, bracteis submembranaceis pellucido-glandulosis obovatis, 3–4 mm. longis, 2–2.5 mm. latis, apice rotundatis, mox caducis; pedicellis gracilibus teretibus 3–5 mm. longis; floribus ♂ solis visis: sepalis 2 submembranaceis eglandulosis suborbicularibus 2.5–3 mm.

diametro, apice rotundatis; petalis 2 submembranaceis obovato-oblongis, sub anthesi 2.5–3 mm. longis et circiter 1 mm. latis, apice rotundatis; staminibus 10–12, 2-seriatis, filamentis subteretibus eglandulosis 0.5–1.5 mm. longis, loculis ellipsoideis 0.6–0.8 mm. longis; carpello unico sterili ellipsoideo sub anthesi circiter 1 mm. longo, basi et apice obtuso, carina stigmatum apicali-ventrali circiter 0.5 mm. longa; fructibus 1-carpellatis subglobosis maturitate 4–5 mm. diametro, pericarpio subcarnoso ruguloso

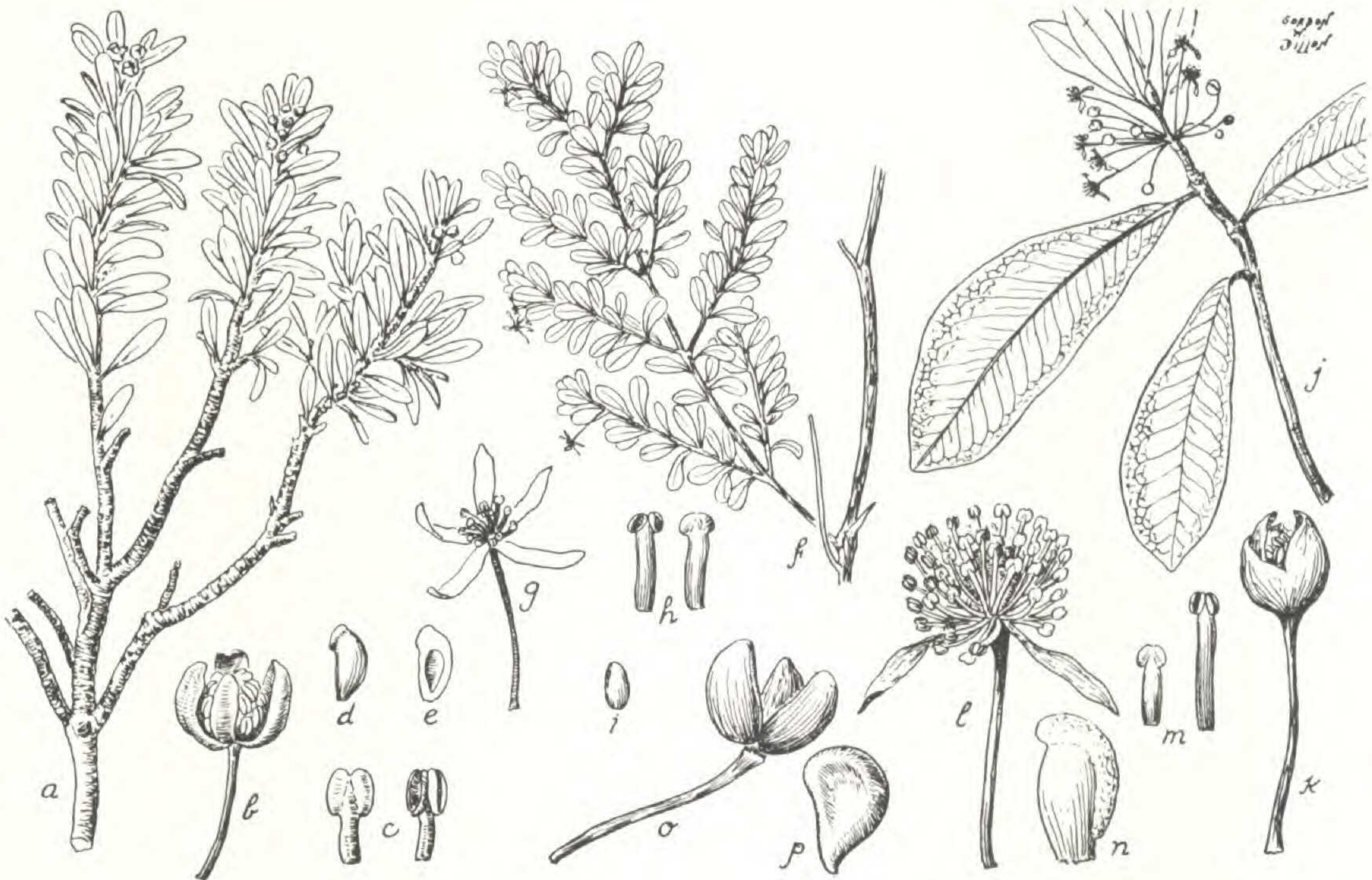


FIG. 3. *a-e*. *Drimys Vickeriana*, drawn from the type: *a*. flowering branchlet, $\times \frac{1}{2}$; *b*. staminate flower, $\times 3$; *c*. stamens, introrse and extrorse views, $\times 5$; *d*. sterile carpel, $\times 5$; *e*. sterile carpel, longitudinal section, $\times 5$. *f-i*. *Drimys microphylla*, drawn from the type: *f*. flowering branchlet, $\times \frac{1}{2}$; *g*. staminate flower, $\times 2$; *h*. stamens, extrorse and introrse views, $\times 5$; *i*. sterile carpel, $\times 5$. *j-n*. *Drimys obovata*, drawn from the type: *j*. flowering branchlet, $\times \frac{1}{4}$; *k*. young staminate flower, $\times 1\frac{1}{2}$; *l*. mature staminate flower, $\times 1\frac{1}{2}$; *m*. stamens, introrse and extrorse views, $\times 5$; *n*. sterile carpel, $\times 5$. *o*, *p*. *Drimys Brassii*, drawn from the type: *o*. fruit, showing three carpels, $\times 1$; *p*. seed, $\times 5$.

obscure glanduloso, seminibus circiter 3 castaneis nitidis obovoideis leviter falcatis, 2.5–3 mm. longis, 1.5–2 mm. latis, basi obtusis, apice rotundatis.

DISTRIBUTION: Southern portion of the Australian Alps, Victoria, at elevations of about 1200–1500 m.

AUSTRALIA: Victoria: Mt. Baw Baw, *Mueller* (US); Mt. Mueller, near Mt. Baw Baw, *J. G. Luehmann & C. French* in 1893 (GH, TYPE, UC), *French* in 1895 (GH, NY, UC).

No specimen is cited with *Parmentier's* brief note on *D. aromatica* var. *alpina*, but the specimen I have selected as the type of the new species bears this herbarium name; the type of *D. lanceolata* var. *parvifolia* is *J. Staer* in April 1911, from the Upper Yarra. In order to avoid ambiguity I have thought it better to propose the above-described entity as a new

species rather than to take up one of the varietal names. The species is named for Miss Joyce W. Vickery, in recognition of her work on the Australian *Drimytes*. Additional specimens are cited with her varietal description, and she describes the leaf-blades as 8–23 mm. long, but none of those available to me exceed 16 mm.

Drimys Vickeriana is very distinct in its compact habit, small crowded leaves, small floral parts, reduced number of stamens and seeds, etc. Like *D. lanceolata*, it has a subglobose 1-carpellate fruit which is rounded at base, while it resembles *D. stipitata* in having only two petals. It appears to me to be one of the most distinct species of the genus, and I am unable to consider it merely a variety of either of its relatives.

NEW GUINEAN AND MALAYAN SPECIES

The Section *Tasmannia* reaches its greatest development in New Guinea, in its total variability, number of species, and number of individuals. Until the extensive exploration of New Guinea began, no more than forty years ago, the genus was supposed to occur there only sparsely, as represented by a very few collections referred to *D. hatamensis* Becc. and *D. piperita* Hook. f. We are now aware that the genus is one of the predominant elements in many of the montane regions of New Guinea, having been collected at all elevations between 800 and 3800 m. Its occurrence toward the lower limit of this altitudinal belt is presumably sparse, and therefore it was not observed in quantity until explorers gained access to the interior mountains. In this treatment I am able to recognize 29 species from New Guinea, although many of these are known to me only from the original descriptions. This number contrasts with the six species known from Australia and Tasmania and the single species known from the Philippines, Borneo, Celebes, and perhaps Amboina.

KEY TO THE NEW GUINEAN AND MALAYAN SPECIES

- Microphyllous species, probably always epiphytic, the leaf-blades 5–10 mm. long.
 Petals 2, about 3 mm. long; stamens about 8, 1- or 2-seriate; leaf-blades 5–7 mm. long7. *D. vaccinioides*.
 Petals 4–6, 4–5 mm. long; stamens 14–18, usually 3-seriate; leaf-blades (5–)6–10 mm. long8. *D. microphylla*.
 Small-leaved species, sometimes epiphytic, usually sclerophyllous, the leaf-blades (0.9–)1–4 (rarely to 5.5) cm. long.
 Leaf-blades (9–)10–18 mm. long, 4–12 mm. broad; petals 2–4, up to 8 mm. long; stamens in staminate flowers 18–27, in hermaphrodite flowers 13–189. *D. buxifolia*.
 Doubtfully distinct from preceding10. *D. Versteegii*.
11. *D. reducta*.
 Leaf-blades (1.5–)2–4(–5.5) cm. long.
 Petals none (rarely 1); stamens in staminate flowers 4–6; leaf-blades lanceolate-oblong, obtusely acuminate at apex12. *D. oligandra*.
 Petals 2; stamens in staminate flowers probably 12–27; leaf-blades elliptic- or oblong-obovate, obtuse or rounded at apex.
 Leaf-blades with obvious venation, (10–)15–25 mm. broad; stamens in pistillate flowers none; petals 4–4.5 mm. long; carpels 2–4; ovules about 1613. *D. rubiginosa*.
 Leaf-blades with immersed venation.

- Carpels in hermaphrodite flowers 5 or 6; stamens 20-25; leaf-blades 15-22 mm. broad14. *D. pittosporoides*.
- Carpels (in fruit) 1-3; seeds 15-24; petals in staminate flowers 5.5-7 mm. long; leaf-blades (4-)6-13 mm. broad15. *D. Brassii*.
- Petals 5 or more (rarely 4); stamens in staminate flowers 12-30 or more.
- Leaf-blades fistulose, strongly revolute at margins, 1-5 mm. broad; petals 10-12, the outer ones broadest and sepaloid.....16. *D. fistulosa*.
- Leaf-blades more or less flattened, at least 5 mm. broad.
- Flowers large, the petals about 18 mm. long and 7 mm. broad; stamens in staminate flowers about 30, the carpel solitary17. *D. elongata*.
- Flowers smaller, the petals less than 10 mm. long.
- Petals 10 or more, variable in size, the outer and inner series smaller than the middle series; stamens about 25; leaf-blades 5-10 mm. broad, with obsolete nerves.....18. *D. myrtoides*.
- Petals 7-14; stamens in staminate flowers 19-22; leaf-blades 12-23 mm. broad24. *D. arfakensis*.
- Petals 4-6.
- Leaf-blades obovate, about 2 cm. long and 1 cm. broad, rigidly coriaceous; petals linear-oblong or subspatulate, about 4 mm. long and 2 mm. broad19. *D. parviflora*.
- Leaf-blades elliptic-obovate, 1.5-3 cm. long, 1-2 cm. broad, thick-coriaceous, with reticulate-prominulous nerves; petals oblanceolate or narrowly oblong, 3-5 mm. long, about 2.5 mm. broad20. *D. pachyphylla*.
- Leaf-blades elongate-obovate or oblong-spatulate, 2-4 cm. long, 0.6-1.4 cm. broad, coriaceous; petals narrowly spatulate, 6-8 mm. long, 1.5-2 mm. broad21. *D. Lamii*.
- Large-leaved trees or shrubs, the leaf-blades usually more than 5 cm. long.
- Leaves verticillate, or at least closely aggregated, in clusters of 3-6; petals 7 or 8.
- Pedicels about 1 cm. long; largest petals about 6 mm. long and 1-1.7 mm. broad; leaf-blades attenuate at base22. *D. verticillata*.
- Pedicels 6-7 cm. long; largest petals about 14 mm. long and 5 mm. broad; leaf-blades broadly rounded at base23. *D. rosea*.
- Leaves alternate or subopposite, not verticillate.
- Petals 5 or more (sometimes 4 in no. 25).
- Flowers small, the petals 4-6 mm. long at anthesis, the stamens in staminate flowers usually 15-22.
- Petals 7-14; leaf-blades obovate-lanceolate, up to 6 cm. long and 2.3 cm. broad24. *D. arfakensis*.
- Petals 4-6; leaf-blades narrowly oblanceolate-oblong, 6-10 cm. long, 1.3-2.5 cm. broad25. *D. reticulata*.
- Flowers larger, the petals 6-14 mm. long at anthesis, the stamens in staminate flowers 25-65 (or rarely more).
- Leaves sessile, whitish beneath, the secondary nerves about 7 pairs; flowers large, the petals in staminate flowers 8 or 9, about 10 mm. long.26. *D. grandiflora*.
- Leaves petiolate (petioles at least 3 mm. long), slightly paler beneath or concolorous.
- Secondary nerves and veinlets sharply insculpted above; sepals 8-10 mm. long and broad; petals 5-7 in staminate flowers, 10-14 mm. long27. *D. macrantha*.
- Secondary nerves and veinlets prominulous on both surfaces, rarely slightly impressed above; sepals 3-6.5 mm. long and broad (rarely to 8 mm.); petals 6-8 (-11) in staminate flowers, usually 6-12 mm. long28. *D. piperita*.
- Petals 2-4.
- Leaf-blades narrow, 1-2.2 cm. broad, 4-8 cm. long, the veinlet-reticulation prominulous on both surfaces.

- Apex of leaf-blades abruptly long-acuminate, the texture pergamentaceous; pedicels 3–4 cm. long29. *D. acutifolia*.
- Apex of leaf-blades obtusish, the texture coriaceous; pedicels 1.8–2 cm. long30. *D. Beccariana*.
- Apex of leaf-blades acuminate, the texture coriaceous; pedicels 1.5–1.7 cm. long31. *D. cyclopum*.
- Leaf-blades broader, usually more than 3 cm. broad and 10 cm. long.
- Leaf-blades obtuse and auriculate at base32. *D. densifolia*.
- Leaf-blades gradually narrowed to base and decurrent on the petiole.
- Veinlet-reticulation of the leaf-blades only faintly prominulous, sometimes obsolete above, the costa raised above; stamens in staminate flowers 35–5533. *D. obovata*.
- Veinlet-reticulation of the leaf-blades conspicuously prominulous, at least beneath; stamens in staminate flowers fewer than 35.
- Leaf-blades chartaceous, the costa nearly plane or slightly impressed above; branchlets 2–4 mm. in diameter toward apex; pedicels 7–25 mm. long34. *D. hatamensis*.
- Leaf-blades rigidly coriaceous, the costa impressed above; branchlets not more than 4 mm. in diameter toward apex; pedicels 30–35 mm. long35. *D. dictyophlebia*.
- Leaf-blades thick-coriaceous, the nerves impressed on the upper surface; branchlets about 7 mm. in diameter toward apex; pedicels to 30 mm. long36. *D. coriacea*.

7. ***Drimys vaccinioides*** Ridley in Trans. Linn. Soc. II. Bot. **9**: 13. *pl. 1, f. 1–6*. 1916.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, made by Kloss on the Wollaston Expedition at an altitude of about 3180 m. on Mt. Carstensz.

This species and the following are sharply characterized by their small-leaved epiphytic habit and small flowers; they are quite unmistakable among the New Guinean *Drimytes*. Differences between the two species are chiefly of degree, but the fact that *D. vaccinioides* has 2 petals and *D. microphylla* 4–6 petals seems to indicate that they are not conspecific.

8. ***Drimys microphylla*** A. C. Sm. in Jour. Arnold Arb. **23**: 418. 1942. FIG. 3, f-i.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, *Brass 12006* (A), from the Idenburg River region at 1800 m.

9. ***Drimys buxifolia*** Ridley in Trans. Linn. Soc. II. Bot. **9**: 13. 1916; A. C. Sm. in Jour. Arnold Arb. **23**: 419. 1942.

Drimys hatamensis sensu F. v. Muell. in Trans. Roy. Soc. Vict. **1**(2): 1. 1889; non Becc.

DISTRIBUTION: Netherlands and British New Guinea, known from the type collection (*Kloss*, Mt. Carstensz) and *Brass 4239*, *4322*, and *4602* (all A, NY) from the Central Division, British New Guinea; also collected by MacGregor (ex F. v. Muell.); alt. 2500–3680 m.

I discussed the variation in this species in 1942 and expressed doubt of the specific status of the two following entities, having seen authentic material of neither of them.

10. ***Drimys Versteegii*** Diels in Nova Guin. Bot. **14**: 77. 1924.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, "Hubrecht-Gruppe, auf offenem Gelände, bei 3100 m. ü. M. (Versteeg apud Pulle n. 2412 . . .)."

11. ***Drimys reducta*** Diels in Nova Guin. Bot. **14**: 77. 1924.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, "Gipfel des Wichmann-Berges, 3000 m . . . (Pulle n. 976)."

Diels has noted the close relationship of this species and the preceding to *D. buxifolia* Ridley. From a comparison of the original descriptions of the three entities, it is difficult to point out characters which will serve to separate them.

12. ***Drimys oligandra*** A. C. Sm. in Jour. Arnold Arb. **23**: 420. 1942.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, *Brass* 12975 (A), from the Idenburg River region at 1300 m.

13. ***Drimys rubiginosa*** A. C. Sm. in Jour. Arnold Arb. **23**: 420. 1942.

DISTRIBUTION: Netherlands New Guinea, known from the type collection, *Brass* 12629 (A), from the Idenburg River region at 2150 m. Probably also represented by *Brass* 9104 (A) from Lake Habbema, 3225 m.

14. ***Drimys pittosporoides*** Diels in Nova Guin. Bot. **14**: 76. 1924.

DISTRIBUTION: Netherlands New Guinea, reported only from the type collection, *Lam* 2167, "Central-Gebirge, Fuss des Doorman-Gipfels, 3250 m. ü. M . . ."

This species is known to me only from the original description, from which I conclude that it is closely related only to the following. It is possible that the montane small-leaved species of New Guinea will prove to be less stable than supposed when ample material is available, at which time the specific lines will need reconsideration.

15. ***Drimys Brassii*** A. C. Sm. in Jour. Arnold Arb. **23**: 421. 1942. FIG. 3, o, p.

DISTRIBUTION: Netherlands New Guinea, in the Lake Habbema and Mt. Wilhelmina region, alt. 3000–3800 m. Represented by *Brass* 9068 (TYPE), 9536, 10671, *Brass & Myer-Drees* 10126, 10303 (all A), and probably also by *Brass & Myer-Drees* 10111 and 10309 (both A).

16. ***Drimys fistulosa*** Diels in Nova Guin. Bot. **14**: 78. 1924.

DISTRIBUTION: Netherlands New Guinea, reported from two collections, *Lam* 1615 and 1653, "Central-Gebirge, unterhalb des Doorman-Gipfels," alt. 3250–3500 m.

From the original description this appears to be a very distinct species, characterized by its very narrow revolute-margined leaf-blades and its numerous petals of diverse sizes.

17. ***Drimys elongata*** Ridley in Hook. Ic. Pl. **31**: pl. 3051. 1916, in Trans. Linn. Soc. II. Bot. **9**: 12. 1916.

DISTRIBUTION: Netherlands New Guinea, reported only from the collection of Kloss on Mt. Carstensz, alt. 750–1650 m. In the second publication cited it is implied that the species is represented by two collections, both apparently unnumbered.

Drimys elongata appears to be a well-marked species, by virtue of its large flowers and elongate pedicels. Its relationship is presumably with the following.

18. ***Drimys myrtoides*** Diels in Bot. Jahrb. **54**: 241. 1916.

DISTRIBUTION: Northeastern New Guinea, reported from several collections (by Ledermann, Schlechter, and Schultze Jena) from the Sepik region and the Torricelli Mts., at altitudes of 800–2070 m. The type collection is *Ledermann* 12877.

Drimys myrtoides is said to be characterized by its epiphytic small-leaved habit and its numerous petals of diverse sizes. One would anticipate the discovery of this species in the neighboring part of Netherlands New Guinea, but I feel reasonably sure that it is not represented in the collections of the Archbold Expeditions.

Diels has also proposed a variety *gracilis* (in Bot. Jahrb. **54**: 242. 1916), based on *Ledermann* 8430 (type coll.) and 11424, from the Sepik region at 1050 m.; it is said to be more slender ("zierlicher") in all parts than the typical form of the species.

19. ***Drimys parviflora*** Ridley in Trans. Linn. Soc. II. Bot. **9**: 12. 1916.

Bubbia parviflora Burtt in Hook. Ic. Pl. **34**: sub *pl.* 3315. 1936.

DISTRIBUTION: Netherlands New Guinea, recorded only from the type collection, Kloss, Mt. Carstensz, alt. about 2500–3330 m.

Burtt has transferred Ridley's species to *Bubbia* without comment, but the original description contains no suggestion that a species of *Bubbia* is represented. The facts that the leaves are very small (2 by 1 cm.) and that the sepals are 2 and connate seem to indicate the place of the plant in *Drimys*. However, Burtt has doubtless seen the specimen and has a good reason for his transfer; if this is correct, Ridley's description must be quite inaccurate. For the time being I treat the species on the basis of its original description, which leads me to believe that it is a close relative of the two following.

20. ***Drimys pachyphylla*** Diels in Nova Guin. Bot. **14**: 78. 1924.

DISTRIBUTION: Netherlands New Guinea, "Central-Gebirge, am Doorman-Gipfel, 3260 m. ü. M.," *Lam* 1812. Probably also *Lam* 1707 from the same locality and altitude.

21. ***Drimys Lamii*** Diels in Nova Guin. Bot. **14**: 77. 1924.

DISTRIBUTION: Netherlands New Guinea, "Unterhalb des Doorman-Gipfels, an offenen Stellen oberhalb der Waldgrenze, 2900 m.," *Lam* 1871; also *Lam* 1928, same locality, alt. 2480 m.

22. ***Drimys verticillata*** Pulle in Nova Guin. Bot. **8**: 633. 1912; Diels in Nova Guin. Bot. **14**: 78. 1924.

DISTRIBUTION: Netherlands New Guinea, "auf dem Gipfel des Hellwig-Gebirges in c. 2000 m. ü. M.," *von Römer* 1214 and 1318 (ex Pulle); same locality, alt. 1800–2600 m., *Pulle* 585, 734, 735, 918 (ex Diels).

According to the descriptions, this species and the following seem well distinguished by having their leaves at least pseudoverticillate; Diels remarks that the leaves of *D. verticillata* are not strictly in whorls.

23. ***Drimys rosea*** Ridley in Trans. Linn. Soc. II. Bot. **9**: 11. 1916.

DISTRIBUTION: Netherlands New Guinea, recorded only from the type collection, made by Kloss on Mt. Carstensz, alt. about 3030 m.

24. ***Drimys arfakensis*** Gibbs, Phyt. Fl. Arfak Mts. 135. 1917; A. C. Sm. in Jour. Arnold Arb. **23**: 423. 1942.

DISTRIBUTION: Netherlands New Guinea, Arfak Mts., alt. 1800–2400 m., known from *Gibbs* 5533, the type, and *Kanehira & Hatusima* 13408 (A).

Not having seen the type collection, I am not certain of the identity of the Kanehira & Hatusima plant, which differs from the description as noted in 1942. Although Gibbs states that the flowers of her specimen are staminate, the fact that she mentions the ovules and does not describe the stamens leads me to believe that she saw only pistillate flowers. The species has small flowers and comparatively small leaves, but its affinities seem to be with my large-leaved group, as indicated in my key to species.

25. *Drimys reticulata* Diels in Bot. Jahrb. **54**: 242. 1916; A. C. Sm. in Jour. Arnold Arb. **23**: 423. 1942.

DISTRIBUTION: Northeastern New Guinea, Sepik region, alt. 1400–1500 m. (*Leder-mann* 12433, type coll.), and the adjacent Idenburg River region of Netherlands New Guinea (*Brass* 11857, 12149, 12494 [all A]), alt. 1800–2150 m.

26. *Drimys grandiflora* Ridley in Trans. Linn. Soc. II. Bot. **9**: 11. 1916.

DISTRIBUTION: Netherlands New Guinea, reported only from the type collection, made by Kloss on Mt. Carstensz, alt. about 3200 m.

27. *Drimys macrantha* A. C. Sm. in Jour. Arnold Arb. **23**: 422. 1942.

DISTRIBUTION: British New Guinea, known only from *Brass* 4519 (A, TYPE, NY), Wharton Range, Central Division, alt. 2840 m.

28. *Drimys piperita* Hook. f. in Hook. Ic. Pl. **9**: pl. 896. 1852; Becc. Malesia **1**: 185. 1877; Stapf in Trans. Linn. Soc. II. Bot. **4**: 128. 1894; Parment. in Bull. Sci. Fr. & Belg. **27**: 227, 302. 1896; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Merr. in Philip. Jour. Sci. **1**: Suppl. 53. 1906, in Philip. Jour. Sci. Bot. **2**: 272. 1907; Merrill & Merritt in Philip. Jour. Sci. Bot. **5**: 349. 1910; Merr. Enum. Philip. Fl. Pl. **2**: 154. 1923.

Tasmannia piperita Miers in Ann. Mag. Nat. Hist. III. **2**: 110. 1858, Contrib. Bot. **1**: 140. 1861.

Drimys reticulata F. v. Muell. Pl. Indig. Col. Vict. **1**: 21, sphalm for *D. piperita*. 1860.

Dioecious shrub or small tree, up to 4 m. high or more, the branchlets subterete, striate-rugulose, 2–5 mm. in diameter near apices, dark brown or purplish, sometimes glaucous when young; leaves scattered along branchlets, the petioles rugulose, shallowly canaliculate, often narrowly winged, (5–)7–14 mm. long, usually stout, (0.5–)1–2 mm. in diameter; leaf-blades coriaceous or thin-coriaceous, often papyraceous or submembranaceous when young, dark brown or dark olivaceous when dried, often glaucous beneath and frequently with a thin wax-like coating (this smooth, dispersed-punctate, sooner or later completely lost), oblong-obovate or narrowly elliptic, (4–)6–17 cm. long, (1.5–)2.5–6(–7) cm. broad, gradually narrowed toward base and decurrent on the petiole, obtuse to gradually acuminate at apex, narrowly recurved at margin, the costa shallowly canaliculate or slightly raised and flattened above, prominent beneath, the secondary nerves (6–)10–14 per side, spreading at an angle of 45–65°, sharply raised on both surfaces or sometimes slightly impressed above, copiously anastomosing toward margin, the veinlets forming an intricate and obvious reticulum, usually sharply prominulous on both surfaces, rarely somewhat obscure or slightly impressed above; flowers usually numerous, aggregated around growing point of branchlets, at length pseudolateral, solitary or fasciculate in clusters of 2–4, subtended by bracts, these often numerous, papyraceous, oblong-deltoid, 7–15 mm. long, 3–8 mm. broad, acute, soon caducous, leaving obvious scars; pedicels slender, 10–37 mm. long; staminate flowers: sepals 2, submembranaceous, sparsely glandular, broadly elliptic or suborbicular, 4–6.5 mm. long, 3.5–6 mm. broad, obtuse or obtusely apiculate at apex; petals 6–8 (rarely to 11), membranaceous, sparsely glandular, oblanceolate, 6–12 mm. long and 1.5–4 mm. broad at anthesis, rounded or obtuse at apex; stamens 25–60, 3–5-seriate, the filaments slightly flattened, eglandular, 1–5 mm. long, the locules oblong-ellipsoid or subglobose, 0.5–1 mm. long, the connective sometimes obscurely glandular at apex; carpels 1–3, sterile, obovoid, 1.5–2 mm. long at anthesis, obtuse at apex, short-

stipitate at base, the stigmatic ridge conspicuous, extending over apex and down the ventral edge nearly to base; pistillate flowers: sepals as in staminate but slightly smaller; petals 5-7, similar to those of staminate flowers but not exceeding 7.5 by 2.5 mm.; stamens none; carpels 2-5, obovoid, 2-2.5 mm. long at anthesis, similar in shape to those of staminate flowers, the ovules 12-30; fruits 1-5-carpellate, the carpels ellipsoid, at maturity 5-15 mm. long and 3-8 mm. broad, obtuse to short-stipitate at base, obtuse or rounded at apex, obviously marked by the stigmatic ridge, the pericarp carnosely, the seeds usually 12-30, castaneous or black, obovoid, slightly or strongly falcate, 2-3 mm. long, 1-1.5 mm. broad, subacute at base, rounded at apex.

DISTRIBUTION: Philippine Islands, Borneo, and Celebes (also reported from Amboina by Beccari), at elevations of 1000-2900 m. (up to 3800 m. on Mt. Kinabalu); usually reported as occurring in mossy-forest and often in exposed situations. The type is from Mt. Kinabalu, Borneo.

PHILIPPINE ISLANDS: Luzon: Ilocos Norte Prov., Mt. Palimlim, *Ramos* 33329 (NY), 33353 (A, GH, UC, US); Benguet Prov., *Loher* 21 (M, NY, US), *Clemens* 17150a (UC); Pauai, *Santos* 32050 (A, UC); Suyoc to Pauai, *Merrill* 4782 (NY, US); Mt. Pulog, *Ramos & Edaño* 44911 (UC); Mt. Pulogloco, *Ramos & Edaño* 40407 (A, UC); Bontoc Prov., *Clemens* 2326 (UC); Mt. Pukis, *Ramos & Edaño* 37822 (A); Mt. Caua, *Ramos & Edaño* 38017 (A, GH); Pauai Benguet to Mt. Data, *Clemens* 7326 (UC); Nueva Vizcaya Prov., Mt. Alzapan, *Ramos & Edaño* 45739 (UC); Nueva Ecija Prov., Mt. Umingan, *Ramos & Edaño* 26297 (A, UC, US); Zambales Prov., *Ramos* 5025 (NY, US); Bataan Prov., Mt. Mariveles and upper Lamao R., *Williams* 745 (NY, US), 754 (GH, NY, US), *Whitford* 149 (NY, US), 1103 (NY, US), *Copeland* 260 (US), *Elmer* 6817 (NY), *Borden* 2093 (NY, US); Rizal Prov., *Loher* 14054 (A), 14060 (UC), 14418 (A), Angilog, *Loher* 5511 (US); Mabiluang, *Loher* 14442 (A, UC); Montalban, *Loher* (UC), 12189 (A, UC); Tabayas Prov., Mt. Camatis, *Edaño* 4519 (A), 4964 (A); Mt. Binuang, *Ramos & Edaño* 28572 (A); Mt. Banahao, *Gates* 7192 (F), *Loher* 13678 (A, UC); Laguna Prov., Mt. Banahao, *Ramos* 19583 (NY, US), *Sulit* 30071 (UC), *Loher* 5512 (US); Camarines Sur Prov., Mt. Isarog, *Edaño* 76264 (NY), 76247 (NY); Mindoro: Mt. Halcon, *Merrill* 6134 (NY, US); Leyte: *Wenzel* 778 (A, GH, M, US); Negros: Canlaon Volcano, *Merrill* 248 (US); Dumaguete, Cuernos Mts., *Elmer* 9912 (A, M, NY, US); Mindanao: Bukidnon Prov., Mt. Lipa, *Edaño* 38561 (A, GH, UC); Mt. Candon, *Ramos & Edaño* 38897 (A), 38905 (A, UC); Agusan Prov., Cabadbaran, Mt. Urdaneta, *Elmer* 13799 (A, F, GH, M, NY, UC, US); Davao Prov., *Kanehira* 2692 (NY); Mt. Apo, *Williams* 2553 (A, NY), *Mearns* (US), *Copeland* 1065 (US), *Elmer* 11410 (M, NY, US), *Clemens* 15609 (UC), 15610 (UC).

BORNEO: British North Borneo: Mt. Kinabalu, *Low* (UC, TYPE COLL.), *Clemens* 10564 (A, UC), 10687 (A), 31670 (A, UC), 31950 (A, UC), 50632 (UC), 50987 (A), *Griswold* 44 (A), 48 (A), 76 (A); Sarawak: Mt. Murud, *Mjoberg* 101 (UC), 102 (UC); Mt. Poi, *Mjoberg* 193 (A, NY, UC); Mt. Dulit, *Richards* 1645 (A), 2507 (A).

CELEBES: Gowa, Lembaja, *Neth. Ind. For. Serv.* 20554 (A, NY); Gowa to Mt. Lompobatang, *Neth. Ind. For. Serv. s. n.* (A).

NATIVE NAMES: In Philippine dialects, as recorded by Merrill, 1923: *Amutútin* (Igorot), *bauang* (Manobo), *inotótan* (Igorot), *lupol* (Bontok), *malagus* (Bagobo).

The above redescription of *D. piperita*, based on abundant material, seems advisable, since the only other descriptions are those of Hooker and Miers, both based entirely on the type collection. This is the only Asiatic species of *Drimys* known to occur outside of New Guinea and Australia. In view of the great diversity of the genus in those regions, it is a striking

contrast to find that the material from the Philippines, Borneo, and Celebes is remarkably constant in its salient characters. I find no basis for the further division of *D. piperita*, although two Philippine specimens not cited above (*Ramos & Edaño* 30731 [A, GH, UC, US], from Mt. Madiass, Panay, and *Elmer* 7747 [A, M, NY, US], from Lucban, Tayabas Prov., Luzon) appear to represent an extreme form. These specimens have unusually large sepals (up to 8 by 7 mm.), as many as 11 petals (whereas no more than 8 were found in the remaining material), which are up to 16 by 5.5 mm., and numerous stamens (up to 100). Since these two specimens are otherwise identical with the bulk of the material, it seems likely that they represent only a local and aberrant form.

The occurrence of *D. piperita* on Amboina is recorded by Beccari, whose determination is very likely correct; however, this station should be verified. It seems possible that the species will also be found on other high islands in the region. Mention of the occurrence of *D. piperita* in New Guinea probably dates from Mueller's record of it in 1889; I believe that Mueller actually had specimens of *D. hatamensis*, for no New Guinean collections referable to *D. piperita* are available to me nor were any cited by Diels.

The relationship of *D. piperita* is with the New Guinean species with large leaves and 5 or more petals, especially *D. macrantha* and *D. grandiflora*, and to a lesser extent *D. arfakensis* and *D. reticulata*. Of these New Guinean species, only *D. macrantha* is sufficiently similar to *D. piperita* to cause any doubt of its specific status; for the time being I believe that these two species are amply distinguished, but it must be kept in mind that the interior of New Guinea is still largely unknown and that future collections may cause students to extend the range of *D. piperita* to that island.

Collectors of material of *D. piperita* have indicated that the petals are white, the stamens yellow, and the fruit at first red, finally black, with a deep purple bitter juice.

29. ***Drimys acutifolia*** Pulle in Nova Guin. Bot. **8**: 633. 1912; Diels in Nova Guin. Bot. **14**: 76. 1924.

DISTRIBUTION: Netherlands New Guinea, "Vorgebirge des Hellwig-Gebirges (Erica-Gipfel) in c. 1400 m. ü. d. M.," von Römer 1044 and 1045 (ex Pulle); "Perameles-Gebirge, 1100 m. ü. M.," Pulle 482 and 483 (ex Diels).

This species and the two following, according to the descriptions, appear to differ from each other in minor characters only. A comparison of the various collections is highly desirable.

30. ***Drimys Beccariana*** Gibbs, Phyt. Fl. Arfak Mts. 133. f. 9. 1917; Diels in Nova Guin. Bot. **14**: 75. 1924.

DISTRIBUTION: Netherlands New Guinea, reported only from the Arfak Mts. as represented by Gibbs 5651 (type coll.) and Gjellerup 1204, alt. 2500-2700 m.

31. ***Drimys cyclosum*** Diels in Nova Guin. Bot. **14**: 76. 1924.

DISTRIBUTION: Netherlands New Guinea, apparently known only from the type collection, Gjellerup 549, from the Cyclops Mts., alt. 1800 m.

Reports of this species from British New Guinea are referred to *D. hatamensis* Becc.

32. ***Drimys densifolia*** Ridley in Trans. Linn. Soc. II. Bot. **9**: 12. 1916.

DISTRIBUTION: Netherlands New Guinea, recorded only from the type collection, made by Kloss on Mt. Carstensz, alt. about 3175–3330 m.

This species is presumably amply differentiated from its allies by having its leaf-blades obtuse and auriculate at base, somewhat like those of the Australian *D. insipida* (R. Br.) Pilger, which in other respects is not a very close relative of *D. densifolia*.

33. ***Drimys obovata*** A. C. Sm. in Jour. Arnold Arb. **23**: 424. 1942. FIG. 3, j-n.

DISTRIBUTION: Netherlands New Guinea, vicinity of Lake Habbema and the Bele River, alt. 2200–2800 m., represented by *Brass* 10567, 10570, 11295 (TYPE), and 11312 (all A).

34. ***Drimys hatamensis*** Becc. Malesia **1**: 185. 1877; Parment. in Bull. Sci. Fr. & Belg. **27**: 227, 301. *pl.* 10, *f.* 38. 1896; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Diels in Bot. Jahrb. **54**: 242. 1916; A. C. Sm. in Jour. Arnold Arb. **23**: 425. 1942.

Drimys piperita sensu F. v. Muell. in Trans. Roy. Soc. Vict. **1**(2): 1. 1889; non Hook. f.

Drimys cyclopum sensu Lane-Poole, Rep. For. Res. Papua 86. 1925; White & Francis in Proc. Roy. Soc. Queensl. **38**: 228. 1927; non Diels.

DISTRIBUTION: Netherlands, Northeastern, and British New Guinea. The type is a Beccari collection from the Arfak Mts. at 2000 m.; also from the Arfak Mts. are *Kanehira & Hatusima* 13785 and 13935 (both A). For the probable occurrence of this species elsewhere in New Guinea and discussions of its status, see Diels in 1916 and my notes in 1942.

35. ***Drimys dictyophlebia*** Diels in Nova Guin. Bot. **14**: 75. 1924.

DISTRIBUTION: Netherlands New Guinea, represented by the type collection, *Pulle* 845, from the Hellwig Mts. at 1900 m., and probably also by *Brass* 13704 (A), from the Idenburg River region at 700 m.

36. ***Drimys coriacea*** Pulle in Nova Guin. Bot. **8**: 634. 1912; Diels in Nova Guin. Bot. **14**: 75. 1924.

DISTRIBUTION: Netherlands New Guinea, Hellwig Mts., alt. 2000–2600 m., *von Römer* 1209, 1281 (ex Pulle), *Pulle* 577, 595, 958, 959 (ex Diels).

According to the original description, this species is amply characterized by its thick-coriaceous leaves and very stout branchlets.

OLD WORLD SPECIES OF DRIMYS EXCLUDED FROM THE GENUS

Many workers in this group have accepted *Drimys* in a very broad sense, taking its limits to be essentially those of the family. Therefore, practically all of the early species were first described in *Drimys*; these binomials are referred to the appropriate species of the other five genera in the following pages. The species listed immediately below, however, should apparently be removed from the family altogether.

DRIMYS MUELLERI Parment. in Bull. Sci. Fr. & Belg. **27**: 227, 300. *pl.* 10, *f.* 36, 37, *nomen subnudum*. 1896; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 83. 1937.

Drimys intermedia Parment. in Bull. Sci. Fr. & Belg. **27**: 223, 224, sphalm for *D. Muelleri*. 1896; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 83. 1937.

The secondary wood of this species does not suggest a species of *Drimys*, as pointed out by van Tieghem (6: 284).

DRIMYS OBLONGA S. Moore in Jour. Bot. **55**: 302. 1917 = ***Hypsophila Halleyana*** F. v. Muell. (Celastraceae), according to Dandy in Jour. Bot. **71**: 45. 1933.

2. BUBBIA

Bubbia v. Tiegh. in Jour. de Bot. **14**: 278, 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Hutchinson in Kew Bull. **1921**: 190. 1921; Dandy in Jour. Bot. **72**: 40. 1934; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 83. 1937.

Bubbia Sect. *Eububbia* v. Tiegh. in Jour. de Bot. **14**: 294. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Bubbia Sect. *Monoclada* v. Tiegh. in Jour. de Bot. **14**: 294. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Bubbia Sect. *Diploclada* v. Tiegh. in Jour. de Bot. **14**: 294. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Tetralthalamus Lauterb. in K. Schum. & Lauterb. Fl. Deutsch. Schutzg. Südsee Nachtr. 319. 1905; Engl. in E. & P. Nat. Pfl. ed. 2. **21**: 229. 1925.

Bubbia is here interpreted to include 30 species, which are distributed eight in New Caledonia, one in Lord Howe Island, two in Queensland, and nineteen in New Guinea. The first species referable to the group was described in 1869 by Mueller (*Drimys Howeana*) and this is also the genotype. The genus is readily separated from *Drimys* on characters pertaining to the calyx, from *Zygogynum* by its separate carpels, from *Pseudowintera* by its terminal inflorescence, from *Belliolum* by its stamens, and from *Exospermum* by its placentation and free carpels (which are rarely appressed-contiguous in young flowers). In many respects *Bubbia* appears to have retained the hypothetical primitive characters of the family better than the other genera, although its carpellary characters are diverse and probably more highly evolved than those of *Drimys* Sect. *Tasmannia*.

Van Tieghem's three sections are based on the greater or lesser degree of branching of the primary rays of the inflorescence, a character which appears of no more than specific value. I find it impossible to propose sectional segregations within the genus, as the inter-relationships of the various species are highly complex. Possibly a classification may eventually be based upon characters of the carpel, such as the position and extent of the stigmatic ridge and the extent of placental areas. The key to the New Guinean species proposed below is entirely artificial.

SPECIES OF NEW CALEDONIA AND LORD HOWE ISLAND

On the basis of herbarium material available in America, it is impossible properly to evaluate the eight species of *Bubbia* reported from New Caledonia and the species from Lord Howe Island. The original descriptions of these species are for the most part inadequate, and a consideration of their status must await examination of the collections in the herbaria at Paris and the British Museum. However, a few brief notes on these entities are given below, in order to bring together references to literature. For lack of a better method, I discuss the names in chronological order.

1. ***Bubbia Howeana*** (F. v. Muell.) v. Tiegh. in Jour. de Bot. **14**: 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 84. 1937.

Drimys Howeana F. v. Muell. Fragm. Phyt. Austral. **7**: 17. 1869; Parment. in Bull. Sci. Fr. & Belg. **27**: 230, 307. 1896.

Drimys insularis Baill. ex F. v. Muell. Fragm. Phyt. Austral. **9**: 76, *nomen*. 1875; Parment. in Bull. Sci. Fr. & Belg. **27**: 230, 307, as synonym. 1896.

Bubbia Muelleri v. Tiegh. in Jour. de Bot. **14**: 293, *nomen*. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109, *nomen*. 1906.

DISTRIBUTION: Lord Howe Island; type collected by C. Moore.

I have seen no material of *Bubbia* from Lord Howe Island, and the original description of *Drimys Howeana* by Mueller does not permit the accurate placing of the species, although its generic identity is beyond doubt. This species was selected by van Tieghem as the type of *Bubbia*. *Drimys insularis* has never been adequately described, and I do not question Vickery's reference (7: 84) of it to synonymy under *Bubbia Howeana*. *Bubbia Muelleri* was named, but not described, by van Tieghem on the basis of Mueller's discussion (Fragm. Phyt. Austral. **7**: 17. 1869) of a second plant from Lord Howe Island, known in fruit only and said by Mueller to be perhaps conspecific with *Drimys Howeana*. The name *Bubbia Muelleri* has no status of consequence, and until collections offer proof to the contrary, one may assume that there is only one species of *Bubbia* on Lord Howe Island.

2. ***Bubbia Balansae*** (Baill.) v. Tiegh. in Jour. de Bot. **14**: 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys Balansae Baill. in Adansonia **10**: 335. 1873; Guillaumin in Ann. Mus. Col. Marseille II. **9**: 95. 1911.

DISTRIBUTION: New Caledonia, apparently known only from the type collection, *Balansa 1844*, from Mt. Humboldt, alt. 1100 m.

Van Tieghem (6: 294) proposes his Sect. *Monoclada* on this species alone. The species is said to be characterized by its very small leaves and flowers and the small number of its inflorescence-rays, each of which bears only two flowers at its summit.

3. ***Bubbia Deplanchei*** v. Tiegh. in Jour. de Bot. **14**: 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys Deplanchei Vieill. ex v. Tiegh., l. c., as synonym.

DISTRIBUTION: New Caledonia, thus far reported only from the type collection, *Vieillard 2279*, from Wagape.

This species is briefly characterized by van Tieghem as having its flowers arranged in a simple umbel; it was the only species of the genus known to him with this character and he placed it alone in his Sect. *Eububbia*. This choice of a sectional name is unfortunate, since elsewhere (6: 278) van Tieghem clearly states that the type-species of the genus *Bubbia* is *B. Howeana*.

4. ***Bubbia auriculata*** v. Tiegh. in Jour. de Bot. **14**: 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; A. C. Sm. in Jour. Arnold Arb. **23**: 438. 1942.

Drimys amplexicaulis Vieill. ex Parment. in Bull. Sci. Fr. & Belg. **27**: 231, 308. *pl.* 10, *f.* 34, *nomen subnudum*. 1896; Vieill. ex v. Tiegh. in Jour. de Bot. **14**: 293, as synonym. 1900; Bak. f. in Jour. Linn. Soc. Bot. **45**: 267. 1921.

Bubbia amplexicaulis Dandy in Jour. Bot. **72**: 40. 1934; Burtt in Hook. Ic. Pl. **34**: sub *pl.* 3315. 1936.

DISTRIBUTION: New Caledonia, reported from the type collection, *Vieillard 2280* (GH) from Wagape, and also from *Compton 1551* (ex Bak. f.) or *1581* (ex Dandy) from Ignambi.

This is one of the species which Burtt (1) believes to weaken the generic

distinctions between *Bubbia* and *Belliolum*. I have recently (3: 438) discussed the points raised by him and also questioned Dandy's acceptance of Parmentier's specific epithet. *Bubbia auriculata* is readily distinguished by its long narrow sessile leaf-blades with auriculate subamplexicaul bases.

5. ***Bubbia heteroneura*** v. Tiegh. in Jour. de Bot. **14**: 294. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys heteroneura v. Tiegh. ex Bak. f. in Jour. Linn. Soc. Bot. **45**: 267. 1921.

DISTRIBUTION: New Caledonia, recorded by van Tieghem from *Vieillard 20* (type coll.) and *Deplanche 293*, both from Puepo; doubtfully reported by Baker from *Compton 1130* from Mt. Canala.

Van Tieghem's description is very inadequate, but, since he mentions a few details of the leaf and cites specimens, the publication must be considered valid.

6. ***Bubbia isoneura*** v. Tiegh. in Jour. de Bot. **14**: 294. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Vieillard 17* (GH), from Wagape.

From the original brief descriptions of the two species, this and *B. heteroneura* appear to be weakly differentiated. Burt (1) has reduced *B. isoneura* to *Bubbia crassifolia* (i.e. *Belliolum crassifolium*). The available type duplicate of *Bubbia isoneura* bears very young fruiting carpels, in which the ovules are aggregated in two closely appressed rows corresponding to the obliquely ventral stigmatic ridge. In this character, therefore, the plant would appear to be properly placed in *Bubbia*, although verification from staminal characters is desirable. In the carpels of *Belliolum crassifolium*, as represented by *Schlechter 15348*, the ovules are in two rows which are slightly removed laterally from the ventral suture of the carpel. This tendency is probably characteristic of *Belliolum*, to which, on the basis of its stamens, *Schlechter 15348* belongs. The two specimens under discussion show slight intangible differences in foliage; on the basis of the evidence now available I cannot agree with Burt's reduction, and therefore I list *Bubbia isoneura* as an independent species.

7. ***Bubbia Comptonii*** (Bak. f.) Dandy in Jour. Bot. **72**: 41. 1934.

Drimys Comptonii Bak. f. in Jour. Linn. Soc. Bot. **45**: 267. 1921.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Compton 1815*, from Mt. Panié, alt. 750–1200 m.

In describing three new species of this complex from New Caledonia, Baker, although his descriptions are fairly complete, omits the staminal details which are necessary to distinguish species of *Bubbia* from those of *Belliolum*. In transferring the specific epithets to *Bubbia*, Dandy has doubtless considered this point and has found that Baker's species belong in *Bubbia* in van Tieghem's original sense, not as later expanded by Burt. It is significant that Baker does not compare any of his three species with any of van Tieghem's; consequently one should see type material of all the New Caledonian species before reaching conclusions as to their specific status.

According to the original description, *B. Comptonii* is characterized by having its stamens often reduced to 3 and its carpel usually solitary.

8. **Bubbia odorata** (Bak. f.) Dandy in Jour. Bot. **72**: 41. 1934.

Drimys odorata Bak. f. in Jour. Linn. Soc. Bot. **45**: 268. 1921.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Compton* 1982 (ex Baker) or 1983 (ex Dandy), from Tonine, alt. above 750 m.

Baker remarks, "The noticeable features of this species are the oblanceolate glabrous leaves with a thick midrib, the flowers with a strong sweet scent, the petals being white with a purple patch towards the base, the generally 5 stamens and 2 carpels."

9. **Bubbia pauciflora** (Bak. f.) Dandy in Jour. Bot. **72**: 41. 1934.

Drimys pauciflora Bak. f. in Jour. Linn. Soc. Bot. **45**: 268. 1921.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Compton* 1761 (ex Baker) or 1768 (ex Dandy), from Mt. Panié, alt. about 450 m.

Baker remarks, "Easily distinguished by the slender leaves much attenuate below, with very slender indistinct lateral nerves, the few flowers on long pedicels, and generally 3 carpels."

AUSTRALIAN SPECIES

The genus *Bubbia* apparently has a very limited range in Australia, thus far being known only from eastern Queensland approximately between latitudes 16° and 18°. To the single species previously reported from this region, *B. semecarpoides*, I here add a second, which is probably a montane derivative from a common ancestor. The two species are essentially similar in fundamental details, but I believe that the points brought out in the following key are of specific value. The specimen from Bellenden Ker which Domin refers to *Drimys semecarpoides* should be re-examined in comparison with my new species. As the descriptions of Mueller and Bailey are incomplete, I have redescribed *B. semecarpoides* from more recent material.

The two Australian species do not show a close affinity to any of the New Guinean species, having floral characters somewhat resembling those of *B. oligocarpa* (Schlecht.) Burtt and its allies, but in foliage they are more suggestive of some of the New Caledonian species.

KEY TO THE AUSTRALIAN SPECIES

- Petioles stout, 2-3 mm. in diameter, 15-27 mm. long; leaf-blades 12-20 cm. long, 3-7 cm. broad, the costa impressed above; inflorescence compound, the primary rays 2- or 3-flowered; stamens 25-32; carpels 5-8 per flower, the ovules 10-16; seeds usually 10-12 at maturity10. *B. semecarpoides*.
 Petioles slender, 1-1.5 mm. in diameter, 5-20 mm. long; leaf-blades 6-12 cm. long, 1.5-4.5 cm. broad, the costa subplane above; inflorescence simple, the flowers rarely paired on short peduncles; stamens 18 or 19; carpels 3 or 4 per flower, the ovules 7-10; seeds 3-6 at maturity11. *B. Whiteana*.

10. **Bubbia semecarpoides** (F. v. Muell.) Burtt in Hook. Ic. Pl. **34**: sub *pl.* 3315. 1936.

Drimys semecarpoides F. v. Muell. in Vict. Nat. **8**: 15. 1891, in Bot. Centralbl. **46**: 204. 1891; F. M. Bailey, Queensl. Fl. **1**: 19. 1899, Compr. Cat. Queensl. Pl. 21. 1913; Domin in Bibl. Bot. **22**[Heft 89]: 115. 1925.

Tree to 20 m. high, the branchlets stout (4-7 mm. in diameter toward apices), subterete, brownish or cinereous; leaves aggregated toward apices of branchlets, the petioles rugulose, semiterete, 15-27 mm. long, stout (2-3

mm. in diameter), the leaf-blades subcoriaceous or chartaceous, dark olivaceous or brownish when dried, concolorous or conspicuously glaucous beneath, oblong- or elliptic-obovate, 12–20 cm. long, 3–7 cm. broad, gradually narrowed to an attenuate base and decurrent on the petiole, rounded or broadly obtuse at apex, narrowly recurved at margin, especially toward base, finely rugulose on both surfaces, the costa impressed above, prominent beneath, the secondary nerves 10–18 per side, erecto-patent at an angle of 45–60°, obscurely anastomosing toward margin, slightly prominulous on both surfaces or nearly obscure, the veinlets immersed; inflorescence pseudo-terminal, sessile, the primary rays apparently about 4, 2.5–8 cm. long including flowers or fruits, once- or rarely twice-branched, 2- or 3-flowered, granular-papillose, the bracts and bracteoles soon caducous, the pedicels 3–5 mm. long before anthesis, up to 15 mm. long in fruit; calyx papyraceous, rotate, deeply 2–4-lobed, the lobes sparsely glandular, ovate-deltoid, 2–3 mm. long and broad, obtuse; petals immature in our specimen (coll. White) but apparently several, carnose; stamens 25–32, 2- or 3-seriate, up to 1.3 mm. long (immature), the filaments subcarnose, flattened, broadened distally, sparsely yellow-glandular, the locules apical, obliquely horizontal, 0.3–0.5 mm. long; carpels 5–8, obovoid, 1.5–2 mm. long slightly before anthesis, contracted toward base, the stigmatic ridge subapical, 0.3–0.6 mm. long, the ovules 10–16, on short ventral-apical placentas; carpels in fruit 5–8, usually 3 or 4 maturing, the others abortive, occasionally only 1 maturing; mature carpels obovoid, up to 12 mm. long (excl. stipe) and 10 mm. broad, the basal stipe stout, about 2 mm. thick and long, the apex rounded, the stigmatic ridge inconspicuous, subapical; pericarp coriaceous, 1–1.5 mm. thick, obscurely rugulose without; seeds usually 10–12 at maturity, closely appressed, oblong-obovoid, slightly falcate, about 5 mm. long and 2.5 mm. thick, subacute at base, rounded at apex.

DISTRIBUTION: Northeastern Queensland, apparently limited to the region from the Atherton Tableland to the vicinity of Rockingham Bay, lat. about 17–18°, at altitudes up to 700 m. The type was collected by W. Sayer on "Russell's Creek," a locality I have not located on modern maps but which is probably near Rockingham Bay. Other collections from this region which have been cited by Bailey and Domin were made by Dallachy, W. Hill, and Domin, the latter from Bellenden Ker.

AUSTRALIA: Queensland: Boonjie, Atherton Tableland, *White* (A); East Malanda, Atherton Tableland, *Kajewski 1216* (A, NY) (common in rain-forest).

Although I have not seen authentic material of Mueller's species, it is obvious from his original description that he had the large-leaved species described above and not the following.

11. *Bubbia Whiteana* sp. nov. FIG. 4, a-f.

Arbor ad 8 m. alta, ramulis subteretibus brunneis crassis, apicem versus 3–4 mm. diametro; foliis secus ramulos copiose dispersis; petiolis rugulosis semiteretibus 5–20 mm. longis, 1–1.5 mm. diametro; laminis coriaceis siccitate olivaceis, utrinque conspicue rugulosis, subtus plerumque glaucis, elliptico-obovatis, 6–12 cm. longis, 1.5–4.5 cm. latis, basi attenuatis et in petiolum decurrentibus, apice rotundatis vel obtusis, margine recurvatis vel conspicue revolutis, costa supra subplana subtus prominente, nervis secundariis utrinsecus 8–15 obscuris angulo 45–60° a costa abeuntibus, rete venularum immerso; inflorescentia pseudoterminali simplici, floribus 3–6 apicem ramulorum circa dispositis raro pedunculo brevi binis, pedicellis

gracilibus papillosis sub anthesi 8–18 sub fructu ad 25 mm. longis; calyce papyraceo rotato profunde 2- vel 3-lobato, lobis parce glandulosis ovato-deltaideis, 2–2.5 mm. longis, 2.5–4 mm. latis, apice obtusis; petalis 6 vel 7 subcarnosis oblongis vel obovato-oblongis, apice rotundatis vel obtusis, exterioribus sub anthesi 6–6.5 mm. longis et 2.5–3.5 mm. latis, interioribus paullo minoribus; staminibus 18 vel 19, 2-seriatis, sub anthesi 1.5–2 mm.

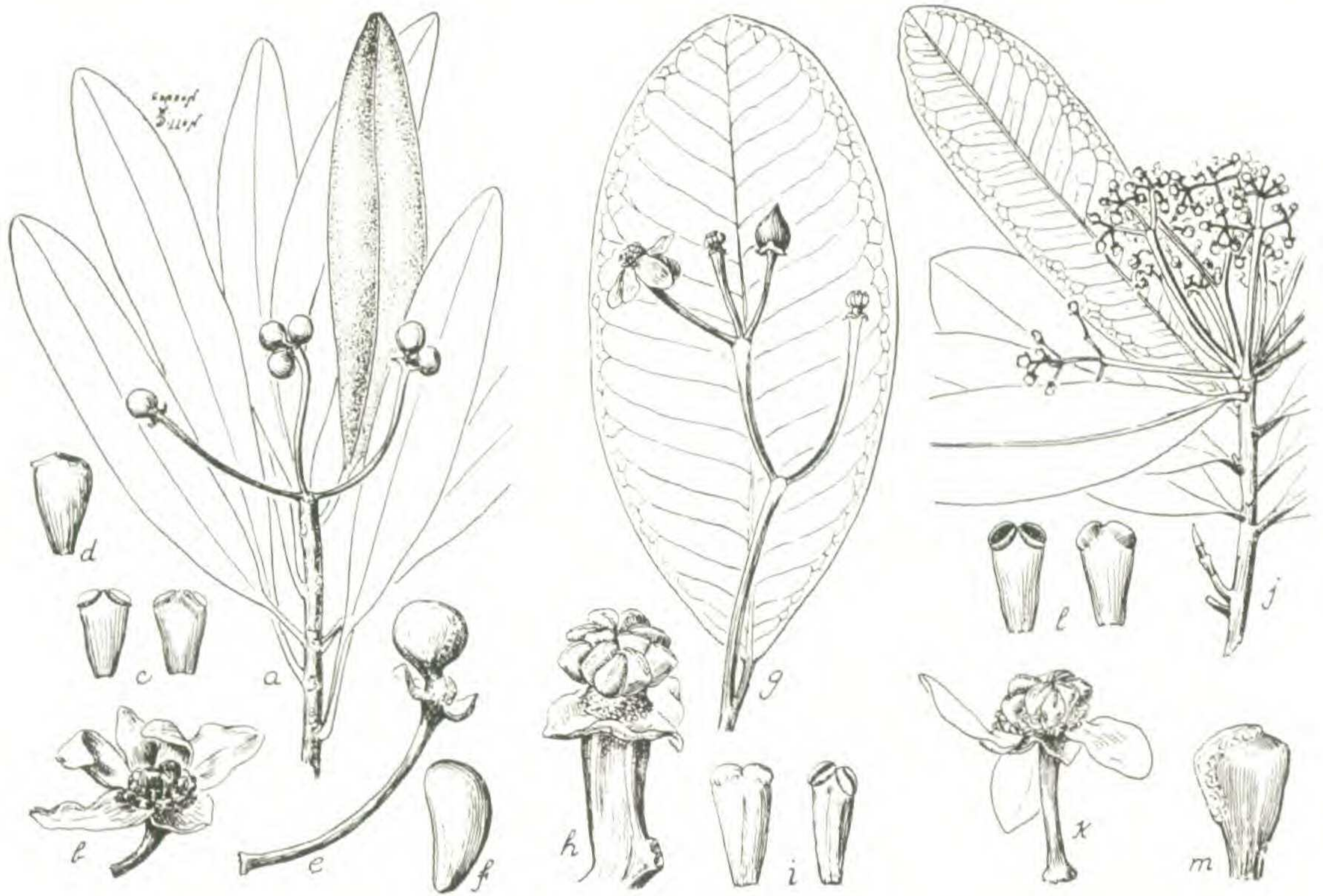


FIG. 4. a-f. *Bubbia Whiteana*, drawn from the type: a. fruiting branchlet, $\times \frac{1}{2}$; b. flower, with two petals removed, $\times 2$; c. stamens, extrorse and introrse views, $\times 5$; d. carpel, $\times 5$; e. fruit, with one mature carpel, $\times 1$; f. seed, $\times 2$. g-i. *Bubbia Clemensiae*, drawn from the type: g. inflorescence and leaf, $\times \frac{1}{4}$; h. flower, past anthesis, with petals and stamens fallen, $\times 1$; i. stamens, introrse and extrorse views, $\times 3$. j-m. *Bubbia Archboldiana*, drawn from the type: j. flowering branchlet, $\times \frac{1}{4}$; k. flower, with two petals removed, $\times 1\frac{1}{2}$; l. stamens, extrorse and introrse views, $\times 5$; m. carpel, $\times 5$.

longis, filamentis complanatis apicem versus incrassatis, loculis apicalibus 0.3–0.5 mm. longis, horizontalibus vel leviter obliquis; carpellis 3 vel 4 obovoideis sub anthesi 1.5–2 mm. longis, basi contractis, carina stigmatum subapicali 0.3–0.5 mm. longa, ovulis 7–10, placentis brevibus ventrali-apicalibus; carpellis fructiferis maturitate 1–3 subglobosis vel obovoideis, 8–11 mm. diametro, basi breviter stipitatis (stipite circiter 2 mm. longo et diametro), apice rotundatis, carina stigmatum obscura brevi subapicali, pericarpio carnoso demum coriaceo 0.5–2 mm. crasso extus obscure ruguloso, seminibus maturitate 3–6 nigris oblongo-obovoideis leviter falcatis, 4.5–5 mm. longis, 2–2.5 mm. crassis, basi obtusis, apice rotundatis.

DISTRIBUTION: Known only from the type locality in northeastern Queensland, lat. about $16^{\circ} 15'$.

AUSTRALIA: Queensland: Thornton Peak (Mt. Alexander), Daintree River

region, alt. 1200–1350 m., *Brass* 2278 (A, TYPE), Mar. 14, 1932 (small tree of the low scrubs near summit; leaves silver-gray beneath, much recurved at margin; flowers yellow, on red pedicels; fruits black), *Kajewski* 1495 (A, NY) (small gnarled tree up to 8 m. high, common in poor scrub on top of mountain; leaves silver beneath; pedicels brown; petals cream-green; fruits black when ripe).

Although the new species is doubtless a close relative of *B. semecarpoides*, I believe that it is worthy of specific rank on the basis of its substantially smaller leaves, simpler inflorescence, and fewer stamens, carpels, ovules, and seeds. The species is named for Dr. C. T. White, of the Botanic Gardens of Brisbane, who has contributed much to our knowledge of Queensland plants.

NEW GUINEAN SPECIES

Bubbia apparently reaches its greatest development in New Guinea, where 19 species are now known. The total variability of the New Guinean population considerably exceeds that of the New Caledonian, as indicated in the extremes of carpel-structure, fruit-size and shape, number and surface of seeds, number of stamens, and types of foliage. Many of the New Guinean species are known from single collections, and some of these I have not seen; therefore the following key is based to a certain extent on descriptions, but in general these are ample. This treatment will need considerable revision when more ample material is available, for it seems certain that additional species will be discovered and that some of the existing ones will need amplification. *Bubbia* is less important than *Drimys* in New Guinea as an element of the vegetation, if one may judge from the existing collections. It occurs at lower elevations, usually between 400 and 2800 m., but sometimes as low as 100 m. and in one species as high as 3600 m. One may assume, from field notes, that the species are usually of scattered occurrence and are never dominant, as are certain species of *Drimys* at high elevations.

KEY TO THE NEW GUINEAN SPECIES

- Leaf-blades comparatively small, 6.5–14 cm. long, 2.5–4.5 cm. broad; inflorescence comparatively few-flowered, the primary rays simple or once- or twice-branched.
- Lateral nerves of the leaf-blades inconspicuous, prominulous or slightly prominent, the blades not bullate.
- Inflorescence simple, about 3-flowered; calyx about 3-lobed; petals about 4 mm. long; carpel 1; leaf-blades papyraceous12. *B. Ledermannii*.
- Inflorescence once- or twice-branched, several-flowered; calyx 5–7-lobed; petals 8–11 mm. long; carpels 3 or 4, adnate at anthesis, at length free; leaf-blades thick-coriaceous13. *B. pachyantha*.
- Lateral nerves of the leaf-blades strongly prominent beneath and impressed above, the blades bullate and coriaceous14. *B. bullata*.
- Leaf-blades larger, 14–40 cm. long, 5–14 cm. broad, rarely slightly smaller; inflorescence many-flowered, the primary rays 2- or 3-times branched (essentially simple in no. 24).
- Lateral nerves of the leaf-blades leaving the costa at an angle of 50–70(–75)°.
- Primary lateral nerves of the leaf-blades 20–40, the blades papyraceous.
.....15. *B. polyneura*.
- Primary lateral nerves of the leaf-blades 8–20 (about 22 in nos. 20 and 22), the blades coriaceous or chartaceous.

- Flowers large, the petals usually 6 in number, 11–17 mm. long, 5–12 mm. broad; calyx irregularly 6–9-lobed; stamens 100–125, 5- or 6-seriate; primary rays of inflorescence 3 or 416. *B. Clemensiae*.
- Flowers smaller, the petals less than 10 mm. long; calyx 2- or 3-lobed (sub-entire in no. 18); stamens not more than 35, usually 2- or 3-seriate.
- Petals 5–10; stigma strictly apical, not extending down the ventral edge of the carpel.
- Primary rays of inflorescence 1–4; petals apparently 5–8, probably not exceeding 8 mm. in length and 3.5 mm. in breadth; stamens 12–18.
- Carpels 1 or 2; stamens about 17 or 18 (possibly 10–20); leaf-blades 20–30 cm. long, 7–12 cm. broad.
- Calyx 3-lobed; petals 6 or 7, about 6 mm. long and 3.5 mm. broad; anther-locules obliquely apical-lateral; carpels 2 ..17. *B. oligocarpa*.
- Calyx essentially circular and entire at margin; petals 5, not more than 5 mm. long and 3 mm. broad; anther-locules horizontal; carpel solitary18. *B. monocarpa*.
- Carpels 3 or 4; stamens 12–16, the anther-locules horizontal.
- Leaf-blades 15–18 cm. long, 4–6 cm. broad; petals 8, the outer ones about 3.5 mm. long and 2 mm. broad; stamens about 12; carpels 4, adnate19. *B. montana*.
- Leaf-blades 35–40 cm. long, 9–11 cm. broad, glaucous and farinose-ceriferous beneath; stamens 14–16; carpels 3, free; fruit sub-globose, up to 3 cm. in diameter, the seeds conspicuously plicate-rugose20. *B. longifolia*.
- Primary rays of inflorescence 6–8; petals 8–10, the outer ones 8–10 mm. long and about 6 mm. broad; stamens 22–35, the anther-locules horizontal; carpels 3–5, free; leaf-blades 14–22 cm. long, 5–7.5 cm. broad21. *B. sylvestris*.
- Petals 4 or 5 (not known in nos. 23 and 24); stigma apical and also extending at least part of the way down the ventral edge of the carpel.
- Primary lateral nerves of the leaf-blades about 22; flowers small, the petals about 2 mm. long; primary rays of inflorescence 5 or 6; stamens about 20; carpels 3 or 422. *B. umbellata*.
- Primary lateral nerves of the leaf-blades 8–15; flowers larger, the petals probably at least 5 mm. long.
- Petioles (0.8–)1–2 cm. long; stigmatic ridge inconspicuous, apparently occupying less than half of both apical and ventral faces of carpel, 3–5 mm. long in fruit; seeds 2–11; rays of inflorescence 3–6.
- Leaf-blades coriaceous, the veinlets usually immersed; rays of fruiting inflorescence 2- or 3-times branched; carpels 4–623. *B. idenburgensis*.
- Leaf-blades chartaceous, the veinlets usually prominulous on both surfaces; rays of fruiting inflorescence essentially simple or once-branched; carpels probably 2 in flower, often solitary in fruit24. *B. glauca*.
- Petioles usually less than 1 cm. long; stigmatic ridge elongate, occupying most of both apical and ventral faces of carpel.
- Primary rays of inflorescence 6–11; carpels 9 or 10; stigmatic ridge occupying about $\frac{2}{3}$ of both apical and ventral faces of carpel; locule straight, the ovules about 16, biseriate ..25. *B. Archboldiana*.
- Primary rays of inflorescence 3–5; carpel 1; stigmatic ridge extending along entire apical and ventral faces of carpel; locule sharply curved, the ovules 50 or more, several-seriate; fruit to 4 cm. by 5 cm., the seeds numerous26. *B. megacarpa*.
- Lateral nerves of the leaf-blades widely spreading, leaving the costa at an angle of 70–85°; venation conspicuous on both surfaces; stigmatic ridge strictly apical.

- Petioles 1–1.8 cm. long; leaf-blades comparatively narrow, 4–6.5 cm. broad, the primary lateral nerves 15–20 per side; rays of inflorescence 10–13 27. *B. argentea*.
- Petioles longer, 1.5–3 cm. long; leaf-blades broader, 6–14 cm. broad, the primary lateral nerves more than 20; rays of inflorescence apparently less than 8.
- Leaf-blades oblanceolate, 6–10 cm. broad, the primary lateral nerves 25 or fewer per side; petioles 1.5–2.5 cm. long.
- Primary rays of inflorescence stout, to 12 cm. long; stamens 25–30; petals 8–10 mm. long 28. *B. calothyrsa*.
- Primary rays of inflorescence slender, 12–15 cm. long; stamens 12–22; petals 5–7 mm. long 29. *B. sororia*.
- Leaf-blades oblong-elliptic, 10–14 cm. broad, the primary lateral nerves 25–35 per side; petioles about 3 cm. long; primary rays of inflorescence to 15 cm. long 30. *B. calophylla*.

12. ***Bubbia Ledermannii*** (Diels) Burttt in Hook. Ic. Pl. **34**: sub. *pl.* 3315, as *B. Ledermannii*. 1936.

Drimys Ledermannii Diels in Bot. Jahrb. **54**: 243. 1916.

DISTRIBUTION: Northeastern New Guinea, reported from *Ledermann 8990* (type coll.) and *8973*, from the Sepik region, alt. about 850 m.

13. ***Bubbia pachyantha*** A. C. Sm. in Jour. Arnold Arb. **23**: 428. 1942.

DISTRIBUTION: British New Guinea, known only from the type collection, *Brass 4371* (A, TYPE, NY), from Mt. Albert Edward, Central Division, alt. 3550–3600 m.

14. ***Bubbia bullata*** (Diels) A. C. Sm. in Jour. Arnold Arb. **23**: 426. 1942.

Drimys bullata Diels in Bot. Jahrb. **54**: 243. 1916.

DISTRIBUTION: Northeastern New Guinea, known only from the type collection, *Schultze Jena 342*, from the Kaiserin Augusta River region.

15. ***Bubbia polyneura*** (Diels) Burttt in Hook. Ic. Pl. **34**: sub. *pl.* 3315. 1936.

Drimys polyneura Diels in Bot. Jahrb. **54**: 244. 1916.

DISTRIBUTION: Northeastern New Guinea, reported only from the type collection, *Ledermann 8986*, from the Sepik River region, alt. about 850 m.

16. ***Bubbia Clemensiae*** A. C. Sm. in Jour. Arnold Arb. **23**: 431. 1942. FIG. 4, g-i.

DISTRIBUTION: Northeastern New Guinea, known only from *Clemens 4596* (A) and *5157* (A, TYPE), from the Morobe District, alt. 1750–1800 m.

17. ***Bubbia oligocarpa*** (Schlecht.) Burttt in Hook. Ic. Pl. **34**: sub *pl.* 3315. 1936.

Drimys oligocarpa Schlecht. in Bot. Jahrb. **50**: 71. *f.* 1. 1913; Diels in Nova Guin. Bot. **14**: 79. 1924.

DISTRIBUTION: Northeastern and Netherlands New Guinea, reported originally from *Schlechter 16470* (TYPE COLL., UC), from Wobbe, Northeastern New Guinea, alt. about 400 m., and *Moszkowski 281*, from Taua, Netherlands New Guinea. Diels adds the following records: *Lam 794*, *1165*, and *1225*, from the Mamberamo region of Netherlands New Guinea, alt. about 200 m.

In keying this species I have relied upon the original description and the type collection, which has about 18 stamens. Diels reports that the Lam collections have 10–20 stamens and have leaves which are variable in width. Even including this variation in one's concept, the species remains clearly separable from its closest allies, which are the three following species in this treatment.

18. ***Bubbia monocarpa*** A. C. Sm. in Jour. Arnold Arb. **23**: 428. 1942.

DISTRIBUTION: Netherlands New Guinea, known only from *Kanehira & Hatusima 12105* (A, TYPE), from Dalman, inland from Nabire, alt. 400 m.

In this species and its close relatives (nos. 17–21 in my key) the stigmatic ridge is strictly apical and the ovules are pendulous.

19. **Bubbia montana** (Lauterb.) A. C. Sm. in Jour. Arnold Arb. **23**: 426. 1942.

Tetrathalamus montanus Lauterb. in K. Schum. & Lauterb. Fl. Deutsch. Schutzg. Südsee Nachtr. 319. 1905, in Bot. Jahrb. **58**: 15. f. 4. 1922; Engl. in E. & P. Nat. Pfl. ed. 2. **21**: 229. f. 100. 1925; Burt. in Kew Bull. **1938**: 458. 1938.

DISTRIBUTION: Northeastern New Guinea, recorded only from the type collection, *Schlechter 13984*, from the Bismarck Mts., alt. 1200 m.

The monotypic genus *Tetrathalamus*, originally placed in the Guttiferae, was first referred to the Winteraceae by Burt.

20. **Bubbia longifolia** A. C. Sm. in Jour. Arnold Arb. **23**: 429. 1942.

DISTRIBUTION: Netherlands New Guinea, known only from *Brass 13868* (A, TYPE), from the Idenburg River, alt. 175 m.

21. **Bubbia sylvestris** A. C. Sm. in Jour. Arnold Arb. **23**: 430. 1942.

DISTRIBUTION: Netherlands New Guinea, Morobe District, alt. 1500–1800 m., known from *Clemens 4122* (A), *4463* (A), *41142* (A, TYPE), and probably also *5008* (A) and *41800* (A) (alt. 750–1350 m.).

22. **Bubbia umbellata** (Ridley) Dandy in Jour. Bot. **72**: 41. 1934.

Drimys umbellata Ridley in Trans. Linn. Soc. II. Bot. **9**: 11. 1916.

DISTRIBUTION: Netherlands New Guinea, reported only from the type collection, made by Kloss in the Otakwa River region, south of Mt. Carstensz, alt. about 1200 m.

23. **Bubbia idenburgensis** A. C. Sm. in Jour. Arnold Arb. **23**: 432. 1942.

DISTRIBUTION: Netherlands New Guinea, Idenburg River region, alt. 900–1250 m., known from *Brass 13028* (A, TYPE) and *13313* (A).

24. **Bubbia glauca** A. C. Sm. in Jour. Arnold Arb. **23**: 433. 1942.

DISTRIBUTION: British New Guinea, known only from *Brass 7191* (A, TYPE), from the upper Fly River region, Western Division, alt. 100 m.

25. **Bubbia Archboldiana** A. C. Sm. in Jour. Arnold Arb. **23**: 433. 1942. FIG. 4, j-m.

DISTRIBUTION: Netherlands New Guinea, known only from *Brass 12712* (A, TYPE), from the Idenburg River region, alt. 2100 m.

26. **Bubbia megacarpa** A. C. Sm. in Jour. Arnold Arb. **23**: 434. 1942.

DISTRIBUTION: Netherlands New Guinea, known only from *Brass 10249* (A, TYPE), from the vicinity of Lake Habbema, alt. 2800 m.

27. **Bubbia argentea** A. C. Sm. in Jour. Arnold Arb. **23**: 436. 1942.

DISTRIBUTION: British New Guinea, known only from *Brass 4740* (A, NY, TYPE), from the Wharton Range, Central Division, alt. 2840 m.

28. **Bubbia calothyrsa** (Diels) A. C. Sm. in Jour. Arnold Arb. **23**: 427. 1942.

Drimys calothyrsa Diels in Bot. Jahrb. **54**: 244. 1916.

DISTRIBUTION: Northeastern New Guinea, reported from *Ledermann 11028* (type coll.) and *11166*, from the Sepik region, alt. 1300–1350 m.; probably also *Ledermann 12978*, from the same region, alt. 1400–1500 m.

29. **Bubbia sororia** (Diels) A. C. Sm. in Jour. Arnold Arb. **23**: 427. 1942.

Drimys sororia Diels in Bot. Jahrb. **54**: 245. 1916.

DISTRIBUTION: Northeastern New Guinea, reported from *Ledermann 11661*, *11898* (type coll.), and *12141*, from the Sepik region, alt. 1900–2070 m.

30. **Bubbia calophylla** A. C. Sm. in Jour. Arnold Arb. **23**: 436. 1942.

DISTRIBUTION: Northeastern New Guinea, known only from *Clemens 5061* (A, TYPE), from the Morobe District, alt. about 1800 m.

3. BELLIOLOM

Belliolum v. Tiegh. in Jour. de Bot. **14**: 278, 330. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Hutchinson in Kew Bull. **1921**: 190. 1921.

Drimys Sect. *Sarcodrimys* Baill. in Adansonia **8**: 200. 1867, Hist. Pl. **1**: 159, 160. 1867-69.

Belliolum Sect. *Monocladiscum* v. Tiegh. in Jour. de Bot. **14**: 331. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Belliolum Sect. *Dicladiscum* v. Tiegh. in Jour. de Bot. **14**: 331. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Belliolum is thus far known to be represented by eight species, four of which occur in New Caledonia and the remainder in the Solomon Islands. However, several of these species are known in fruiting condition only, and, since the distinction between *Bubbia* and *Belliolum* depends primarily upon staminal characters, there is reason to question the generic disposition of these species. The geographic distribution of *Belliolum* forms a curious contrast to that of *Bubbia*; both genera are known from New Caledonia, but the first is lacking from New Guinea and the second is lacking from the Solomons. To be sure, future collections may modify this picture, and no conclusions should be drawn from our present incomplete knowledge of this distribution.

In proposing the genus (6: 278), van Tieghem states that it is typified by two species of Baillon, *Drimys crassifolia* and *D. Pancheri*, but in a subsequent footnote (6: 331) he states that, of the four species he refers to *Belliolum*, the flowers of only *B. Pancheri* are known. It is evident, therefore, that van Tieghem's concept of *Belliolum* is based primarily upon *B. Pancheri* and that this may be designated as the type species.

The first description of a plant belonging to this group is Baillon's description of *Drimys crassifolia*, which is proposed as the type of *Drimys* Sect. *Sarcodrimys*. This fact has no bearing upon the designation of a lectotype for *Belliolum* v. Tiegh. Van Tieghem's two sections are based upon the degree of branching of the inflorescence, but this is surely merely a detail of specific value and demonstrates no basic cleavage in the genus.

Burt (1) has discussed in some detail the reasons for his reduction of *Belliolum* to *Bubbia*, and I have elsewhere (3: 437-438) expressed the tentative opinion that the two genera are maintainable. The latter arrangement is continued in the present treatment, but the question can be finally settled only by the examination of more abundant material than is now available.

NEW CALEDONIAN SPECIES

To the four species, all from New Caledonia, upon which *Belliolum* was originally based, no more from that region have been added up to the present. As I have seen type material of only one of these species, a final evaluation of them is impossible, and it is even uncertain whether all of them belong in the genus, since *Bubbia* and *Belliolum* are not positively to be distinguished in the absence of stamens. The New Caledonian species are listed in the order suggested for them by van Tieghem.

1. ***Belliolum Pancheri*** (Baill.) v. Tiegh. in Jour. de Bot. **14**: 330. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys Pancheri Baill. in *Adansonia* **10**: 336. 1873; Guillaumin in *Ann. Mus. Col. Marseille II.* **9**: 95. 1911; Bak. f. in *Jour. Linn. Soc. Bot.* **45**: 267. 1921.

Bubbia Pancheri Burt. in *Hook. Ic. Pl.* **34**: sub *pl.* 3315. 1936.

DISTRIBUTION: New Caledonia; in the original publication Baillon cites 6 specimens (of Pancher, Vieillard, and Balansa) without indicating a type, but perhaps, because of the specific epithet, one should designate the Pancher collection ("inter sylvas, ad 300 metr. alt.") as the actual type. Guillaumin and Baker have added other specimens in their citations, but van Tieghem has definitely removed two of Baillon's original specimens from this concept and referred them to *Belliolum rivulare* and *Bubbia isoneura* respectively.

Belliolum Pancheri is the single species referred by van Tieghem to his Section *Monocladiscum*, characterized by having each ray of the inflorescence simply umbellate. Baillon's description of the stamens demonstrates beyond doubt that the species falls into *Belliolum* rather than *Bubbia*.

2. ***Belliolum crassifolium*** (Baill.) v. Tiegh. in *Jour. de Bot.* **14**: 330. 1900; Pilger in *E. & P. Nat. Pfl. Nachtr.* **2**: 109. 1906.

Drimys crassifolia Baill. in *Adansonia* **8**: 199. 1867, *Hist. Pl.* **1**: 159. 1867-69; Guillaumin in *Ann. Mus. Col. Marseille II.* **9**: 95. 1911.

Bubbia crassifolia Burt. in *Hook. Ic. Pl.* **34**: sub *pl.* 3315. 1936.

DISTRIBUTION: New Caledonia; the type and only specimen originally cited by Baillon is an unnumbered collection of Vieillard from Balade. Guillaumin cites nine specimens as representing this species, in complete disregard of the fact that van Tieghem, some years earlier, had cited several of them as representing three other species of *Belliolum* and *Bubbia*.

I have seen no material which I can refer with certainty to *Belliolum crassifolium*. *Schlechter 15348* (A, GH), which has been referred to this species by Guillaumin, Burt., and the present writer (3: 437), does not agree in all respects with Baillon's description, but on the other hand it almost certainly represents none of the other three New Caledonian species referred to *Belliolum* in the present treatment.

3. ***Belliolum Vieillardii*** v. Tiegh. in *Jour. de Bot.* **14**: 331. 1900; Pilger in *E. & P. Nat. Pfl. Nachtr.* **2**: 109, as *B. Vieillardii*. 1906.

Drimys Vieillardii Baill. ex v. Tiegh. in *Jour. de Bot.* **14**: 331, as synonym. 1900.

DISTRIBUTION: New Caledonia; van Tieghem cites *Vieillard 16* and *47*, from Balade.

The species is said to be characterized by its stout branches and large leaves, but a comparison of van Tieghem's brief description with Baillon's description of *Drimys crassifolia* is not too convincing; a comparison of type material is obviously desirable.

4. ***Belliolum rivulare*** v. Tiegh. in *Jour. de Bot.* **14**: 331. 1900; Pilger in *E. & P. Nat. Pfl. Nachtr.* **2**: 109. 1906.

Drimys rivularis Vieill. ex Parment. in *Bull. Sci. Fr. & Belg.* **27**: 229, 306. *pl.* 10, *f.* 33, *nomen subnudum*. 1896; Vieill. ex v. Tiegh. in *Jour. de Bot.* **14**: 331, as synonym. 1900.

Bubbia rivularis Burt. in *Hook. Ic. Pl.* **34**: sub *pl.* 3315. 1936.

DISTRIBUTION: New Caledonia; known with certainty only from the type collection, *Vieillard 2278* (F, GH), from Wagape. Parmentier has based his concept in part on a collection by Pancher (l. c. 230), which may not be conspecific with the Vieillard specimen.

The type collection bears young fruiting carpels, which are fairly numer-

ous (5–8 per flower) and have a short subapical stigmatic ridge and ventral placentas. On the basis of the latter character, the species may fall into either *Belliolum* or *Bubbia*, and final determination must await the collection of flowering specimens. The small leaves, ascending secondaries, and large freely branching inflorescences characterize the species, which is quite distinct.

This species and the two preceding were placed by van Tieghem in his Section *Di cladiscum*, with the primary rays of the inflorescence branched twice. Actually, the inflorescence-rays of *B. rivulare* are 2, 3, or 4 times branched.

SOLOMON ISLANDS SPECIES

The four species of *Belliolum* from the Solomon Islands have all been recently described. As two of them are known in fruiting condition only, a dependable key cannot at present be proposed. However, characters of foliage and fruit amply differentiate the species, and the flowers of the first two species listed below indicate that good floral characters may also be expected in the others. For discussions of specific characters, the reader is referred to my earlier treatment (3). The species of this region are all characterized by having carpels with a short apical stigmatic ridge and horizontal placentas situated near the middle; that is, the placentas do not correspond in position to the external stigmatic surface. On the basis of present evidence, I judge that the New Caledonian species have a more primitive type of carpel, with the stigmatic ridge obliquely apical and the placentas more nearly corresponding to this position. Future study may indicate these characters to be a basis for sectional differentiation.

5. ***Belliolum haplopus*** (Burt) A. C. Sm. in Jour. Arnold Arb. **23**: 438. 1942.

Bubbia haplopus Burt in Hook. Ic. Pl. **34**: pl. 3315. 1936.

DISTRIBUTION: Solomon Islands; the type collection is *Waterhouse 90* (F, NY), from Bougainville, while other collections are *Kajewski 1658, 1994, and 2007* (all A), from Bougainville, and *Brass 2959* (A), from Ulawa. The species occurs in rain-forest at altitudes up to 850 m.

6. ***Belliolum Burtianum*** A. C. Sm. in Jour. Arnold Arb. **23**: 439. 1942. FIG. 5, a-e.

DISTRIBUTION: Solomon Islands, known only from the type, *Kajewski 1680* (A), from Bougainville, alt. 950 m.

7. ***Belliolum gracile*** A. C. Sm. in Jour. Arnold Arb. **23**: 439. 1942.

DISTRIBUTION: Solomon Islands; the type is *Brass 2898* (A), from San Cristoval; other collections are *Brass 3063 and 3063A* (both A), from San Cristoval, and *Kajewski 2630* (A), from Guadalcanal. The species grows in forest at 900–1700 m.

8. ***Belliolum Kajewskii*** A. C. Sm. in Jour. Arnold Arb. **23**: 440. 1942.

DISTRIBUTION: Solomon Islands, known only from *Kajewski 2099* (A, TYPE), from Bougainville, and *Kajewski 2574* (A), from Guadalcanal, at altitudes of 1200–1500 m.

4. PSEUDOWINTERA

Pseudowintera Dandy in Jour. Bot. **71**: 121. 1933.

Drimys J. R. & G. Forst. Char. Gen. 83, pro parte, excl. *D. Winteri*. 1776; sensu Cheesem. Man. N. Zeal. Fl. 29. 1906, ed. 2. 455. 1925.

Wintera sensu Forst. f. Fl. Ins. Austr. Prodr. 42. 1786; v. Tiegh. in Jour. de Bot. **14**: 277, 290. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Hutchinson in Kew Bull. **1921**: 190. 1921; non Murray (1784).

Drimys Sect. *Drimys* DC. Reg. Veg. Syst. Nat. **1**: 442. 1817.

Drimys Sect. *Eudrimys* DC. Prodr. **1**: 78. 1824; Baill. Hist. Pl. **1**: 158, 160. 1867-69.

Wintera Sect. *Euwintera* v. Tiegh. in Jour. de Bot. **14**: 291. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906.

Wintera Sect. *Pleurowintera* v. Tiegh. in Jour. de Bot. **14**: 291. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906.

The generic status of the New Zealand species of the Winteraceae has been subject to confusing vicissitudes. *Drimys* J. R. & G. Forst. was based



FIG. 5. *a-e*. *Belliolum Burtianum*, drawn from the type: *a*. flowering branchlet, $\times \frac{1}{2}$; *b*. flower, $\times \frac{3}{4}$; *c*. stamens, extorse and introrse views, $\times 5$; *d*. carpel, $\times 3$; *e*. carpel, longitudinal section, $\times 3$. *f-j*. *Pseudowintera axillaris* var. *typica*, drawn from Cheeseman (Coromandel): *f*. flowering branchlet, $\times \frac{1}{2}$; *g*. flower, $\times 1\frac{1}{2}$; *h*. stamens, extorse and introrse views, $\times 5$; *i*. carpel, $\times 5$; *j*. carpel, longitudinal section, $\times 5$. *k, l*. *Pseudowintera axillaris* var. *colorata*, drawn from Cockayne 183: *k*. fruit, with two mature carpels, $\times 1\frac{1}{2}$; *l*. seed, $\times 3$.

in part upon the New Zealand *D. axillaris*, but van Tieghem, who first definitely broke up the inclusive generic concept, took the Magellanic *D. Winteri* as the genotype, leaving the New Zealand *D. axillaris* without a generic name. The fact that De Candolle had earlier selected *D. axillaris* as representing *Drimys* Sect. *Drimys* (or Sect. *Eudrimys*) does not affect the typification of the genus. In 1786, the younger Forster, following Murray, apparently abandoned the generic name *Drimys* and took up the later *Wintera* Murr., applying it to the New Zealand species. In so doing, Forster did not propose *Wintera* as a new genus. However, van Tieghem

applied to the generic concept based on *Drimys axillaris* the name "*Wintera* Forster, non Murray," remarking (6: 277) that: "Le nom de *Wintera* Murray n'existe pas." This curious conclusion does not alter the fact that *Wintera* is a direct synonym of *Drimys* and is applicable only to the concept based on *D. Winteri*. Dandy (2) has discussed the problem and has quite properly proposed the new generic name *Pseudowintera* for the New Zealand species, selecting *Drimys axillaris* as the type species.

Pseudowintera is not closely related to *Drimys*, having a type of calyx, stamen, and carpel much more suggestive of the genus *Bubbia*, which is certainly its closest ally. On floral characters it is difficult satisfactorily to separate these two genera, but the inflorescence of *Bubbia* is always terminal or pseudoterminal, the primary rays of the inflorescence (or the flowers, when these are single) being arranged around the growing point of the branchlets. When the growing point protrudes through the inflorescence, this may persist for a short while in a pseudolateral position, as in *Drimys*, but at its inception the inflorescence is essentially terminal. In *Pseudowintera*, on the other hand, the inflorescence is axillary at its inception, and flowers arise from a lateral position often on branchlets of several years' growth. Furthermore, the flowers are comparatively reduced in size and the inflorescence is greatly compacted, while the small leaves give a distinct facies to the New Zealand species. The wood-ray is of a different aspect, as will be discussed in a future consideration of intergeneric relationships.

Van Tieghem's two sections are based upon the supposed position of the inflorescence, which he states to be both axillary and terminal in Sect. *Euwintera* (as represented by *Wintera terminalis* v. Tiegh.) and only axillary in Sect. *Pleurowintera* (as represented by three other species). Dandy points out that *W. terminalis* is merely an inconsequential form of *Pseudowintera axillaris*; van Tieghem's sections have no real foundation.

Current opinion among students of this group recognizes three species, but I am unable to distinguish *Pseudowintera colorata* from *P. axillaris* as a species, and therefore I find the genus to consist of only two species, one of which has two varieties.

KEY TO THE SPECIES

- Erect bushy shrub or small tree 2–10 m. high, the branchlets cinereous or purplish or brownish; leaf-blades usually 3–11 cm. long; flowers in fascicles of 2–10, rarely solitary; petals 4–6.5 mm. long; stamens 10–18, rarely as few as 6; carpels usually 2 or 3 (rarely 1, 4, or 5) 1. *P. axillaris*.
 Compact shrub to 2 m. high, the branchlets reddish; leaves crowded, the petioles closely appressed to branchlets, the blades 2–3 cm. long; flowers often solitary, sometimes paired; petals about 3 mm. long; stamens 5 or 6; carpel solitary ... 2. *P. Traversii*.

1. *Pseudowintera axillaris* (J. R. & G. Forst.) Dandy in Jour. Bot. 71: 121. 1933.

Glabrous shrub or tree, up to 10 m. high, the branchlets subterete, rugulose, cinereous or purplish or brownish, slender, 1–3 mm. in diameter toward apices; petioles rugulose, shallowly canaliculate, 5–10 mm. long, 0.8–1.5 mm. in diameter; leaf-blades subcoriaceous, rarely subpapyraceous, olivaceous or dark brown above when dried, usually paler beneath and copiously white- or brownish-punctate, usually glaucous beneath in var. *colorata* and

often coated with a smooth thin layer of wax, obovoid-elliptic or elliptic, (1.5–)3–11(–12.5) cm. long, (1–)1.5–5 cm. broad, acute at base and decurrent on the petiole, obtuse at apex, essentially plane or narrowly recurved at margin, the costa plane or slightly grooved above, prominent beneath, the secondary nerves 4–12 per side, erecto-patent, copiously anastomosing, prominulous or nearly plane above, prominulous beneath, the veinlets forming a fine reticulum, prominulous or obscure on both surfaces; inflorescences axillary or arising from defoliate branchlets, the flowers fasciculate in clusters of 2–10, rarely solitary, usually borne on pulvinate glomerules, subtended by minute deltoid subcoriaceous bracts; pedicels slender, 5–15(–21) mm. long; calyx papyraceous, essentially eglandular, rotate, 2.5–3.5 mm. in diameter, entire or irregularly crenate or shallowly 2-lobed, the lobes broadly ovate, up to 1.5 mm. long and 2.5 mm. broad, rounded or obtuse at apex, entire or slightly crenulate or shallowly 3-dentate; petals 5 or 6, submembranaceous or thin-carnose, copiously opaque-glandular, oblong or obovate-oblong, 4–6.5 mm. long, 2–3.5 mm. broad (inner ones sometimes reduced to 1–2 mm. in width), obtuse or rounded at apex; stamens (6–)10–18, often 2-seriate, oblong-obovate, flattened, carnose, 1.2–2 mm. long, the filaments narrowed at base, broadened to 0.5–1 mm. distally, yellow-glandular distally, the pollen-sacs oblique on the distal margin, ellipsoid, 0.3–0.5 mm. long, dehiscing by lateral-apical clefts, contiguous or slightly separated but not exceeded by the truncate apex of filament; carpels usually 2 or 3 (rarely 1, 4, or 5), obovoid, 1.3–2 mm. long at anthesis, rounded at apex, the stigmatic ridge short, linear-oblong, 0.2–0.5 mm. long, strictly apical or obliquely subapical, the ovary-wall densely glandular, the ovules 8–10, pendulous from short subapical or obliquely apical placentas; carpels in fruit usually reduced to 1, sometimes 2 or 3, subglobose, 5–6 mm. in diameter at maturity, rounded at base and apex, the stigmatic ridge essentially apical, inconspicuous, the pericarp subcarnose, densely glandular, rugulose without, the seeds (2–)3–6 at maturity, obovoid, 3–4 mm. long, 1.5–2.5 mm. broad, obtuse at base, rounded at apex.

In view of the difficulty one has in separating herbarium specimens of *Pseudowintera axillaris* and *P. colorata*, an examination of works on the New Zealand flora in which this problem is considered is of interest. Raoul, in 1846, described the new species *Drimys colorata* without comparing it with *D. axillaris*. Hooker, in 1852, merely remarks: "I cannot distinguish the *D. colorata* of Raoul from Forster's plant." Kirk, in 1889, reduced *Drimys colorata* to a variety of *D. axillaris*, pointing out that the former is essentially a southern plant in New Zealand and the latter essentially northern, although the two overlap in the Wellington region; he further remarks that "the characters stated above [var. *colorata*] pass into those of the typical form by almost imperceptible gradations." Cheeseman, in 1906, retains both species but remarks: "I have considerable hesitation in re-establishing this [*Drimys colorata*] as a species. It is certainly very close to the preceding [*D. axillaris*], and in the dried state it is often difficult to separate the two. But in the field it can always be readily distinguished, and all my correspondents regard it as distinct. The two species grow intermixed in many localities in the Wellington and Nelson Districts." Cockayne, in 1928, retains both species, pointing out the distributional differences and stating that *Drimys axillaris* is much taller than

D. colorata and has larger, glossy, dark green leaves, rather than yellowish green leaves, which are blotched red or purple and are glaucous beneath.

The prevalent modern opinion seems to be that the two species are distinguishable and are good entities, although it is admitted that hybridization occurs in the region where the two ranges overlap. Naturally, New Zealand botanists who have observed the genus in nature are best qualified to judge how distinct the two plants actually are, and for that reason I hesitate to go back to the earlier opinions and combine them. However, a careful examination of the cited specimens shows that there are absolutely no floral distinctions, with the possible exception of a slight and undependable tendency toward more entire calyces in *Pseudowintera colorata*. As to the differences in habit and foliage pointed out by various students, these are scarcely noticeable in herbarium material, although the extreme forms are of course easily distinguished. For instance, the leaf-blades of such specimens as *Colenso* and *Cockayne 183* are grayish white beneath, and one would have no hesitation in referring them to Raoul's species. But the leaf-blades of *Cockayne 3470* and the *Setchell* collection are only slightly paler beneath and sometimes nearly concolorous; yet these also doubtless represent Raoul's species. The best distinction one can make between the two groups, I believe, is based on tendencies toward a smaller habit, smaller leaves, and paler lower leaf-surfaces in *Pseudowintera colorata*. If these characters could be linked with any pertaining to the inflorescence, however inconspicuous, one would feel justified in retaining both species, but my present opinion is that only one specific entity can be admitted.

In view of the differences pertaining to habit and leaf color, however, I cannot altogether ignore the entity based on *Drimys colorata*, especially as this has a more or less distinct geographic range and is apparently readily recognized in a living condition. Therefore I propose varietal combinations for the two entities, one based on the Forsters' type and the other on Raoul's species. The description which I have given above is comprehensive, while the few points which differentiate the varieties are pointed out below.

1a. ***Pseudowintera axillaris* var. *typica* nom. nov.** FIG. 5, f-j.

Drimys axillaris J. R. & G. Forst. Char. Gen. 84. f. 42, a-l. 1776; Forst. f. in Nova Acta Reg. Soc. Sci. Ups. 3: 182. 1780; L. f. Suppl. 270. 1781; Lam. Encycl. 2: 331. 1786; DC. Reg. Veg. Syst. Nat. 1: 443. 1817, Prodr. 1: 78. 1824; A. Rich. Bot. Voy. Astrolabe 290. 1832; Endl. Enchir. Bot. 430. 1841; Hook. f. in Hook. Ic. Pl. 6: pl. 576. 1843; Raoul, Choix de Pl. Nouv.-Zél. 47. 1846; Hook. f. Fl. Nov. Zél. 1: 12. 1852; Miers in Ann. Mag. Nat. Hist. III. 2: 43. 1858, Contrib. Bot. 1: 132. 1861; Hook. f. Handb. N. Zeal. Fl. 10. 1864; Baill. Hist. Pl. 1: 158. f. 203, 204. 1867-69; Kirk, Forest Fl. N. Zeal. pl. 1. 1889; Featon, Art Alb. N. Zeal. Fl. 12. pl. 5, f. 3. 1889; Kirk, Students' Fl. N. Zeal. 22. 1899; Cheesem. Man. N. Zeal. Fl. 29. 1906, ed. 2. 456. 1925.

Wintera axillaris Forst. f. Fl. Ins. Austr. Prodr. 42. 1786; Willd. Sp. Pl. 2: 1240. 1800; Pers. Syn. Pl. 2: 84. 1806; v. Tiegh. in Jour. de Bot. 14: 290. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. 2: 108. 1906; Cockayne in Bull. N. Zeal. State For. Serv. 4(2): 43. 1928, in Engl. & Drude, Veg. der Erde ed. 2. 14: 125. 1928.

Wintera terminalis v. Tiegh. in Jour. de Bot. 14: 291. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. 2: 108. 1906.

Pseudowintera axillaris Dandy in Jour. Bot. 71: 121. 1933.

Tree 4–10 m. high; leaf-blades (3–)4–11(–12.5) cm. long, often paler beneath but scarcely glaucous, the waxy layer inconspicuous, the secondary nerves usually 6–12, the veinlets usually prominulous but often obscure on both surfaces; calyx crenulate or bilobed, rarely entire.

DISTRIBUTION: North Island (from Ahipara and Bay of Islands [lat. about 35°] southward) and northern part of South Island, not occurring south of the Banks Peninsula (lat. about 43° 45'), at altitudes from sea-level to about 850 m.; apparently often occurring in mixed beech forest, or occasionally in pure beech forest (ex Cockayne). The type was collected by the Forsters, but no definite locality was noted.

NEW ZEALAND: North Island: Coromandel, *Cheeseman* (US); Mt. Egmont Ranges, *Tryon* (A); Ohakune, *Oliver* (UC); Wellington, *Travers* (GH); Hunua, *Kirk* (A, F, GH, M), 347 (GH, US); without definite locality: *Cheeseman* (F).

NATIVE NAME: *Horopito*.

Wintera terminalis v. Tiegh. is based on a specimen collected by Sinclair, without definite locality, which is said to differ from the other New Zealand species in having its inflorescences both axillary and terminal; upon this species van Tieghem based his Section *Euwintera*. Although the original description is quite inadequate, I cite this as a synonym of the Forsters' concept on the authority of Dandy.

1b. ***Pseudowintera axillaris* var. *colorata*** (Raoul) comb. nov. FIG. 5, k, l.

Drimys colorata Raoul in Ann. Sci. Nat. III. 2: 121. 1844, Choix de Pl. Nouv.-Zél. 24. pl. 23. 1846; Parment. in Bull. Sci. Fr. & Belg. 27: 227, 303. 1896; Cheesem. Man. N. Zeal. Fl. 30. 1906, ed. 2. 456. 1925.

Drimys axillaris var. *colorata* Kirk, Forest Fl. N. Zeal. pl. 2. 1889, Students' Fl. N. Zeal. 22. 1899.

Wintera colorata Raoul ex v. Tiegh. in Jour. de Bot. 14: 290. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. 2: 108. 1906; Cockayne in Bull. N. Zeal. State For. Serv. 4(2): 43. 1928, in Engl. & Drude, Veg. der Erde ed. 2. 14: 125. 1928.

Wintera monogyna v. Tiegh. in Jour. de Bot. 14: 291. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. 2: 108. 1906.

Pseudowintera colorata Dandy in Jour. Bot. 71: 121. 1933.

Erect bushy shrub or small tree, usually not exceeding 4 m. in height; leaf-blades (1.5–)3–9 cm. long, sometimes blotched with red or purple, usually glaucous beneath, often conspicuously so, the waxy layer often conspicuous, the secondary nerves usually 4–6, the veinlets usually obscure on both surfaces; calyx often entire, rarely crenulate or bilobed.

DISTRIBUTION: North, South, and Stewart Islands, said to occur from Patetere Plateau and Rotorua (lat. about 38°) southward, at altitudes of sea-level (toward the south and in Stewart Island, where it is reported as common) to about 1000 m.; usually subalpine or montane in North Island. The type is the Raoul collection cited below.

NEW ZEALAND: Poketitiri, *Meebold* 5548 (NY); North Island: *Kirk* (GH); Wellington, *Travers* (GH); South Island: Otira Valley, *Cockayne* 183 (GH), 3470 (NY); Akaroa, Banks Peninsula, *Raoul* (TYPE COLL., GH, US), *Kirk* (A, F, M); Mt. Sinclair, Banks Peninsula, *Meebold* 4710 (NY); Hunter Hills, South Canterbury, *Anderson* 213 (A, M, NY, UC, US); Lake Manipouri, *Setchell* (UC); without definite locality: *Colenso* (GH), *Védel* (US), *Oliver* (UC).

NATIVE NAMES: *Pepper-tree*, *craoutink* (ex Raoul). In discussing *Drimys axillaris*, Featon uses the names *pepper-tree* and *Maori painkiller*, which are more likely to refer to var. *colorata*.

Dandy has referred *Wintera monogyna* v. Tiegh. to the synonymy of *Pseudowintera Traversii*, but I am more inclined to believe that it represents the present variety. It is said to differ from Raoul's species in its smaller and more rounded leaves and especially in its single carpel. The latter character has been noted in some specimens of var. *colorata*, and the leaf-shape is too variable to be of much consequence. Van Tieghem does not mention the stamens as being exceptionally few in number, a point which he probably would have emphasized if his plant represented *P. Traversii*. Furthermore the type of *Wintera monogyna* was collected by Hombron at Akaroa (the type locality of Raoul's species), whereas *P. Traversii* has not been authentically reported from that part of the South Island.

2. ***Pseudowintera Traversii*** (Buchanan) Dandy in Jour. Bot. **71**: 122. 1933.
Hymenanthera Traversii Buchanan in Trans. New Zeal. Inst. **15**: 339. *pl.* 28, *f.* 1-1*b.* 1883.
Drimys Traversii Kirk in Trans. New Zeal. Inst. **30**: 379. 1898; Cheesem. Man. N. Zeal. Fl. 30. 1906, ed. 2. 456. 1925, Ill. N. Zeal. Fl. **1**: *pl.* 8. 1914.
Wintera Traversii Cockayne in Bull. N. Zeal. State For. Serv. **4**(2): 43. 1928, in Engl. & Drude, Veg. der Erde ed. 2. **14**: 262. 1928.

DISTRIBUTION: South Island, apparently limited to the northwestern portion, from near the northern tip of the island southward to the Buller River region, probably not occurring much farther south than latitude 42°; altitude up to about 900 m. The type was collected by Travers in the Collingwood district.

Having seen no specimens referable to this species, I am acquainted with it only through the above references. The descriptions of Kirk and Cheeseman (in 1906) are quite adequate, and an excellent plate was published by Cheeseman in 1914. The species is characterized by its compact habit, being a shrub from 0.7 to 2 m. high, often straggling or semi-prostrate, with reddish branches and branchlets. The leaves are crowded and more or less imbricate, with petioles closely appressed to the branchlets and with coriaceous blades which are 2-3 cm. long, 0.8-1.3 cm. broad, and glaucous beneath. The pedicels are often solitary, sometimes paired; the calyx is entire, the petals 5 or 6 and about 3 mm. long, the stamens 5 or 6 and uniseriate, and the carpel solitary.

5. EXOSPERMUM

Exospermum v. Tiegh. in Jour. de Bot. **14**: 279, 333. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Hutchinson in Kew Bull. **1921**: 190. 1921.

Exospermum is known only from the two New Caledonian species upon which it was originally founded; the type is *E. stipitatum*. Van Tieghem's classification (6: 354) has the genus most closely related to *Zygogynum*, with which it has in common "carpelles unis, à placentation médiane." In his discussion, however, van Tieghem points out that the carpels of *Exospermum* are only superficially united and not firmly concrescent as in *Zygogynum*, while the placentation of *E. Lecarti* (6: 339) is "en même temps marginale, latérale et médiane pour chaque carpelle . . ." In effect, the genus is more suggestive of *Bubbia* than of *Zygogynum* and might conceivably be combined with the former, although for the present I feel justified in retaining it as outlined by van Tieghem.

1. **Exospermum stipitatum** (Baill.) v. Tiegh. ex Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Hutchinson in Kew Bull. **1921**: 190. *fig.* 1921. FIG. 6, a-e.
Zygogynum stipitatum Baill. in Adansonia **10**: 334. 1873; Guillaumin in Ann. Mus. Col. Marseille II. **9**: 95. 1911.
Drimys neo-caledonicus Vieill. ex Baill. in Adansonia **10**: 335, as synonym. 1873.
Drimys Lenormandii Vieill. ex Parment. in Bull. Sci. Fr. & Belg. **27**: 231, 308. *pl.* 10, *f.* 35, *pl.* 11, *f.* 42, 43, *nomen subnudum*. 1896; Vieill. ex v. Tiegh. in Jour. de Bot. **14**: 333, as synonym. 1900; Vieill. ex Guillaumin in Ann. Mus. Col. Marseille II. **9**: 95, *nomen*. 1911.
Drimys austro-caledonicus Vieill. (pro parte) ex v. Tiegh. in Jour. de Bot. **14**: 333, as synonym. 1900.

DISTRIBUTION: New Caledonia; the type was collected by Vieillard at Wagap (ex Baillon), or "dans les montagnes de Ti-Ouaka près de Wagape" (ex van Tieghem); a single leaf of this is available (A). Van Tieghem also cites *Vieillard 2281* (GH), the source of the name *Drimys Lenormandii*; from a comparison of the foliage, one may suspect that this is the same collection as the type, which was unnumbered.

Van Tieghem's description of this species is very detailed and accurate, although my observations of the gynaecium lead me to believe that he attaches too much importance to the regularity of the carpel-arrangement. In one flower available to me there are 6 carpels in a single whorl, in a second flower there are 7 carpels, of which one has apparently been pushed into the center by pressure. Van Tieghem reports the carpels as occurring in two whorls of 3-5 carpels each. No petals are available on our material, but van Tieghem describes these as occurring in three tetramerous whorls, implying a degree of regularity which is not found in the related genera. In this species the placentation is said to be limited to the external face of the carpels, but actually the ovules also occupy a portion of the distal lateral faces and the apical-ventral angle.

In his treatment of the plant, van Tieghem neglected to make the actual combination *Exospermum stipitatum*, apparently through an oversight, for he repeatedly mentions "Exosperme stipité" and gives *Zygogynum stipitatum* as a synonym. It appears that Pilger was the first to use the correct Latin binomial.

2. **Exospermum Lecarti** v. Tiegh. in Jour. de Bot. **14**: 334. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Lécart 141*, without definite locality; probably a detached leaf (A) under this name, but labelled *Lécart 144*, is actually from the same collection.

Van Tieghem mentions that this is similar in foliage to the preceding, but differs from it by its usually solitary and short-pedicellate flowers, fewer carpels, and more extensive placental surface. The ovules are said to be situated at the internal angle of the carpel, on the lateral faces, and also on the external face. This is interpreted, by van Tieghem, as a transitional stage between the carpel of *Bubbia* and *Belliolum* (which he supposes always to have the ovulation along the ventral angle) and that of *Exospermum stipitatum*, in which the ovules are supposedly situated only on the external face of the carpel. The carpels of *E. Lecarti* are only weakly united, and in this respect the species is similar to some species of *Bubbia*, i.e. *B. montana* (Lauterb.) A. C. Sm. and *B. pachyantha* A. C. Sm. It

appears that the ovulation in *Bubbia* and *Belliolum* is more diverse than supposed by van Tieghem, and the placental surface is not always restricted to the ventral angle of the carpel in those genera. Consequently, the primary characters upon which *Exospermum* is founded do not sharply distinguish the genus from *Bubbia* and *Belliolum*, although the stamens amply separate it from the latter. However, I do not propose to unite *Exospermum* with *Bubbia*; although it doubtless represents an extreme trend from a *Bubbia*-like ancestor, it seems to be sufficiently characterized by its ovulation to merit generic status. However, I believe that its closest alliance is with *Bubbia* rather than with *Zygogynum*.

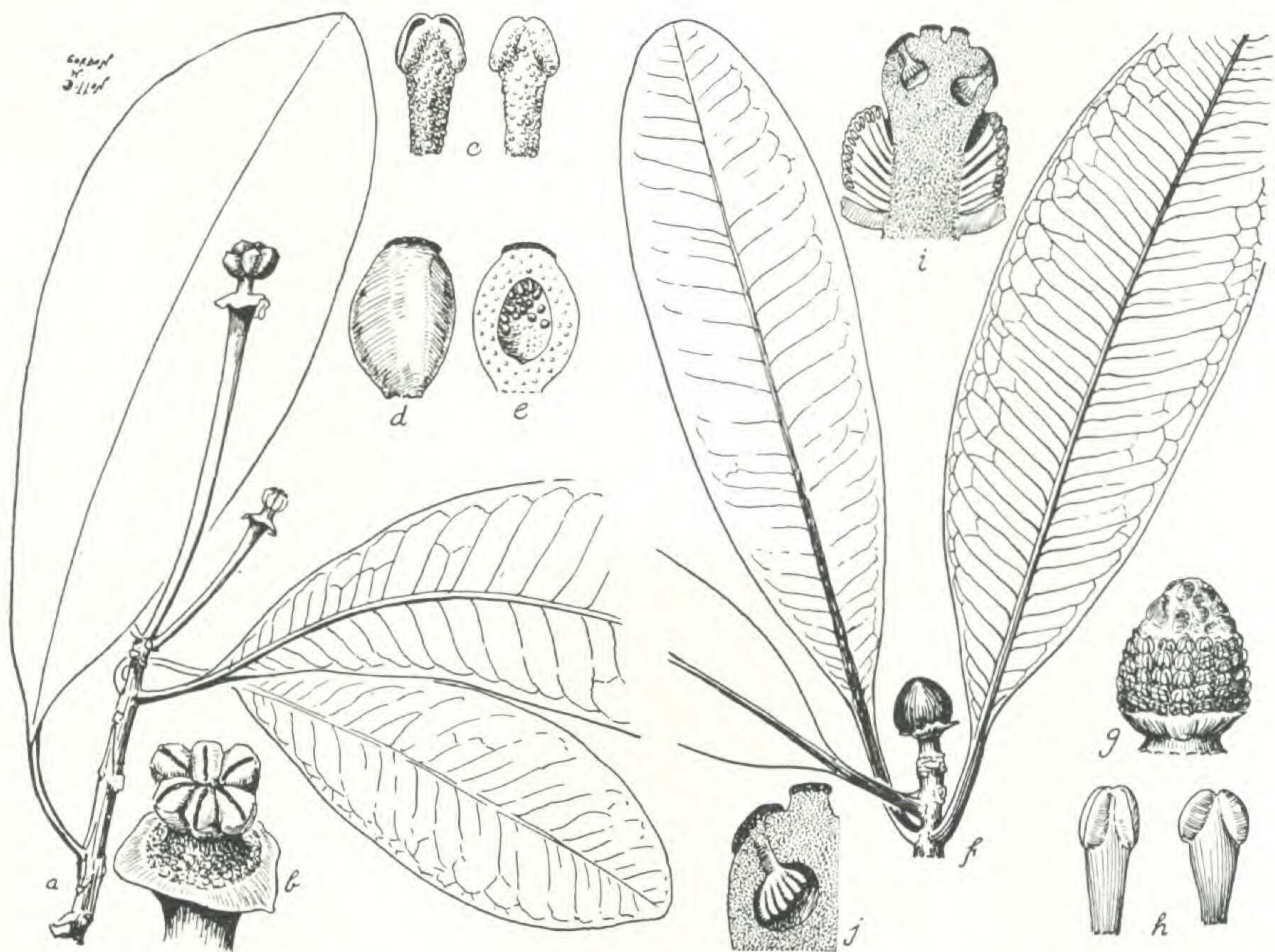


FIG. 6. *a-e*. *Exospermum stipitatum*, drawn from Vieillard 2281: *a*. branchlet with two flowers past anthesis, $\times \frac{1}{2}$; *b*. flower, past anthesis, the petals and stamens having fallen, $\times 2$; *c*. stamens, extrorse and introrse views, $\times 5$; *d*. carpel, $\times 2$; *e*. carpel, longitudinal section, showing the glandular wall and the scattered ovules, $\times 2$. *f-j*. *Zygogynum Vieillardii*, drawn from Franc 1740: *f*. branchlet with solitary terminal young flower, $\times \frac{1}{2}$; *g*. flower with calyx and petals removed, $\times 1\frac{1}{2}$; *h*. stamens, extrorse and introrse views, $\times 5$; *i*. longitudinal section of young flower, showing torus with stamens and fused carpels, $\times 2$; *j*. enlarged section of *i*, showing two stigmas, one locule (with one row of ovules removed), and the connecting canal, $\times 4$.

6. ZYGOGYNUM

Zygogynum Baill. in *Adansonia* 7: 298. 1867, *Hist. Pl.* 1: 160, 190. 1867-69; Prantl in *E. & P. Nat. Pfl.* III. 2: 19. 1891; v. Tiegh. in *Jour. de Bot.* 14: 279, 340. 1900; Pilger in *E. & P. Nat. Pfl. Nachtr.* 2: 109. 1906; Hutchinson in *Kew Bull.* 1921: 191. 1921.

Zygogynum Sect. *Monanthum* v. Tiegh. in Jour. de Bot. **14**: 341. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Zygogynum Sect. *Pleianthum* v. Tiegh. in Jour. de Bot. **14**: 341. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Zygogynum has been generally accepted by workers on the New Caledonian flora as a good genus. It is indeed the most distinct genus of the family in many respects, with a unique type of carpellary specialization. No species have been added to *Zygogynum* since it was amplified by van Tieghem to include six species. In *Zygogynum* the carpels are firmly concrescent and the ovules are limited to the external face of the locule; van Tieghem interprets these facts as a continuation of the trend begun in *Exospermum*, which may indeed be true, although the remarkable syncarpy of *Zygogynum* is only faintly suggested by the loosely coherent carpels of *Exospermum*. The two genera have a common aspect in their reduced inflorescences, the flowers being either solitary and terminal or few in a terminal umbel (perhaps more properly described as single and clustered around the growing point).

The two sections proposed by van Tieghem are based on solitary versus aggregated flowers, a division which seems arbitrary and not very useful, since the flowers in the second group are often reduced to one soon after anthesis. The principal basis of speciation may eventually be found to occur in the gynaecium, as suggested by van Tieghem (6: 347–348), the number and disposition of the carpels varying from species to species.

Baillon's paper discussing his new species does not include a formal generic description, nor does the generic name appear as an independent entity in the text, being first mentioned as such in a brief summary (op. cit. 372). However, the description of *Zygogynum Vieillardii* may be taken as a *descriptio generico-specifica*.

The species are here briefly discussed in the order proposed by van Tieghem.

1. ***Zygogynum Vieillardii*** Baill. in *Adansonia* **7**: 298. *pl.* 4. 1867, *Hist. Pl.* **1**: 161. *f.* 208–210. 1867–69; Parment. in *Bull. Sci. Fr. & Belg.* **27**: 232. 1896; v. Tiegh. in *Jour. de Bot.* **14**: 340. 1900; Pilger in *E. & P. Nat. Pfl. Nachtr.* **2**: 109, as *Z. Vieillardii*. 1906; Guillaumin in *Ann. Mus. Col. Marseille II.* **9**: 95. 1911. FIG. 6, f–j.

DISTRIBUTION: New Caledonia; the type collection is *Vieillard 187*, from mountains near Balade. Guillaumin adds citations of *Pancher 17* and *283* from Mt. Koghi, neither of which I have seen, and *Balansa 2763* from Mt. Mou, of which a fragment (A) seems very possibly to represent this species, although it is also suggestive of *Z. Bailloni*. The only specimen in American herbaria which I can positively refer to *Z. Vieillardii* is *Franc 1740* (A, UC), from Prony.

The species is well described and figured by Baillon; it is characterized by its 10–12 concrescent carpels with elliptic or subcapitate stigmas.

2. ***Zygogynum Bailloni*** v. Tiegh. in *Jour. de Bot.* **14**: 340. 1900; Pilger in *E. & P. Nat. Pfl. Nachtr.* **2**: 109, as *Z. Baillonii*. 1906.

DISTRIBUTION: New Caledonia; the type was collected by Pancher in 1870, apparently without number or definite locality, and is represented by a leaf (A) which is essentially identical to those of *Franc* (A), from Mt. Mou, a sterile specimen which may be referred to *Z. Bailloni* with reasonable certainty.

Zygogynum Bailloni is compared by van Tieghem to *Z. Vieillardii*, from which it differs in having its leaf-blades more coriaceous and glossy, and in having 4 carpels with sessile linear stigmas rather than 10–12 carpels with elliptic stigmas. This is the only species of the genus elaborated in detail by van Tieghem (6: 341–345); it is said to have a very short and stout pedicel, 8 petals in two whorls, and carpels concrescent except at the apices. The difference in stigmatic characters between this species and the remaining species of *Zygogynum* causes van Tieghem (6: 348) to speculate on its generic status. On the basis of his discussion, one might assume that *Z. Bailloni* is the most primitive species of the genus in its retention of a linear stigmatic ridge.

3. ***Zygogynum bicolor*** v. Tiegh. in Jour. de Bot. **14**: 341. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

DISTRIBUTION: New Caledonia; reported only from the type collection, *Lécart 41* (A, leaf), without definite locality.

Zygogynum bicolor is said by van Tieghem to resemble *Z. Vieillardii* in its solitary flower on a short stout pedicel, but it is distinguished by having its leaf-blades very pale beneath and is further characterized by its very numerous stamens, 147–168 in 7 or 8 whorls (6: 346).

4. ***Zygogynum pomiferum*** Baill. in Adansonia **10**: 334. 1873; v. Tiegh. in Jour. de Bot. **14**: 340. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Guillaumin in Ann. Mus. Col. Marseille II. **9**: 95. 1911.

DISTRIBUTION: New Caledonia; the species was originally based by Baillon on two collections, *Balansa 2328* (A, TYPE COLL.), from Kanala (alt. 800 m.), and *2804*, from Mt. Mou. Van Tieghem did not believe these to be conspecific and took the first as the type, referring the second to his *Z. Balansae*. Guillaumin cites a collection of Lecard from Bourail as representing *Z. pomiferum*.

The original description is ample, the species being distinguishable from all others except the following by its comparatively broad leaf-blades. The type collection is in fruit only.

5. ***Zygogynum Balansae*** v. Tiegh. in Jour. de Bot. **14**: 340. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Bak. f. in Jour. Linn. Soc. Bot. **45**: 268. 1921.

DISTRIBUTION: New Caledonia; the type collection is *Balansa 2804*, from Mt. Mou, alt. 700 m. Baker cites *Compton 1776*, from Mt. Panié, as representing the species.

Zygogynum Balansae is compared by van Tieghem with *Z. pomiferum*; it has similarly large leaves and flowers grouped in a simple sessile umbel, but it is said to differ in having the leaf-blades less coriaceous, longer, narrower, distally attenuate, and with the lateral nerves more distant and "plus reticulées." It is further characterized by its very numerous carpels and large fruits, these being up to 4 cm. in diameter, according to van Tieghem (6: 348).

6. ***Zygogynum spathulatum*** v. Tiegh. in Jour. de Bot. **14**: 341, as *Z. spatulatum*. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys austro-caledonicus Vieill. (pro parte) ex v. Tiegh. in Jour. de Bot. **14**: 341, as synonym. 1900.

DISTRIBUTION: New Caledonia; reported only from the original collection, *Vieillard 2266* (GH, TYPE COLL.) from Wagape.

Zygogynum spathulatum resembles *Z. pomiferum* and *Z. Balansae* in having its flowers aggregated, but it is distinguished by its narrow spatulate leaf-blades, which are rounded at apex and attenuate at base. The carpels are about 20 in number.

PRINCIPAL LITERATURE CITED

1. BURTT, B. L. *Bubbia haplopus*. Hook. Ic. Pl. **34**: pl. 3315 (pp. 1-3). 1936.
2. DANDY, J. E. The Winteraceae of New Zealand. Jour. Bot. **71**: 119-122. 1933.
3. SMITH, A. C. Studies of Papuanian Plants, V. Jour. Arnold Arb. **23**: 417-443. 1942.
4. ————. The American species of *Drimys*. Jour. Arnold Arb. **24**: 1-33. f. 1-3. 1943.
5. ————. La Distribution géographique et l'Histoire des Winteraceae. Boissiera, 1943 (in press).
6. TIEGHEM, P. VAN. Sur les dicotylédones du groupe des Homoxylées. Jour. de Bot. **14**: 259-297, 330-361. 1900.
7. VICKERY, JOYCE W. Two new species and one new variety of *Drimys* Forst., with notes on the species of *Drimys* and *Bubbia* van Tiegh. of south-eastern Australia and Lord Howe Island. Proc. Linn. Soc. N. S. Wales **62**: 78-84. f. 1, 2; pl. 5. 1937.
8. WHITAKER, T. W. Chromosome number and relationship in the Magnoliales. Jour. Arnold Arb. **14**: 376-385. f. 1-4; pl. 80. 1933.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.